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AD-A227 130

INSTALLATION RESTORATION PROGRAM

PHASE I - RECORDS SEARCH

BOLLING AFB, WASHINGTON, D.C.

PREPARED FOR

UNITED STATES AIR FORCE
AFESC/DEV
Tyndall AFB, Florida
and
HQ MAC/DEEV
Scott AFB, Illinois

MAY 1985

ES ENGINEERING-SCIENCE

NOTICE

This report has been prepared for the United States Air Force by Engineering-Science for the purpose of aiding in the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

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INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH
BOLLING AFB, Washington, D.C.

Prepared For

UNITED STATES AIR FORCE
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Tyndall AFB, Florida
and
HQ MAC/DEEV
Scott AFB, Illinois

May 1985

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EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Installation Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development; and Phase IV, Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Bolling Air Force Base (AFB) under Contract No. F08637 84 C0070.

INSTALLATION DESCRIPTION

Bolling AFB is located in southeastern Washington, DC at the confluence of the Potomac and Anacostia Rivers. The base is bordered to the west by the Potomac River, to the east by the South Capital Street/I-295 Corridor, and U.S. Navy facilities to the north and south. The main base site comprises 616.5 acres.

The base was originally established as Bolling Field in 1918 in the area just north of its present location. In 1930 the land area currently occupied by the base was purchased and by 1940 all units were transferred to this site and the old airfield was turned over to the Navy. Bolling Field was used extensively during World War II and served as an experimental station for a number of aircraft considered for use by the military or federal government. In 1948 the command was redesignated to Headquarters Command, USAF and the site was renamed Bolling Air Force Base. In 1962, all fixed wing aircraft operations were transferred to Andrews AFB and the mission was changed to an administrative one.

The base is currently used as an administrative and personnel support center for overall Air Force activities in the National Capital Region (NCR).

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points relevant to Bolling AFB:

- The mean annual precipitation is 42.6 inches and net annual precipitation is calculated to be 5.6 inches.
- Flooding is not known to be a problem at the base.
- Base surface soils are primarily fill materials. Their infiltration rates and permeabilities are highly variable. Surface soils present in a narrow band on the eastern portion of the installation are sandy and probably have higher permeability rates. Much of the base has been developed; building construction and pavement covers a significant portion of the land surface.
- A shallow aquifer, consisting of alluvium or alluvium and fill materials exists on base and is present at or near ground surface. Water levels within this unit range from five to twenty feet below grade. This aquifer is assumed to be in hydraulic communication with the Potomac River. The base is located in the recharge zone of the aquifer.
- Two minor shallow water-bearing units occupy areas of limited extent in the highland section of the base. Little is known of their characteristics; test borings indicate shallow water levels. These units are assumed to direct discharge to the alluvium or similar units occurring at lower topographic positions. Part of the installation is located in what appears to be the recharge area(s) of these units.
- None of the water-bearing units identified in the study area are known to be utilized as a source of water supplies. The installation and adjacent consumers obtain water supplies from the municipal water distribution system.

- No threatened or endangered species of plants or animals are known to either reside on base or to be transients in the study area.

METHODOLOGY

During the course of this project, interviews were conducted with installation personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state and federal agencies; and field surveys were conducted at suspected past hazardous waste activity sites. Three sites (Figure 1) were initially identified as potentially containing hazardous contaminants and having the potential for contaminant migration resulting from past activities. These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-on investigation.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team field inspection, reviews of base records and files, interviews with base personnel, and evaluations using the HARM system.

All three sites rated were found to have sufficient potential to create environmental contamination. These sites are as follows:

- Heating Plant Oil Leak
- Fire Protection Training Area
- Landfill No. 1

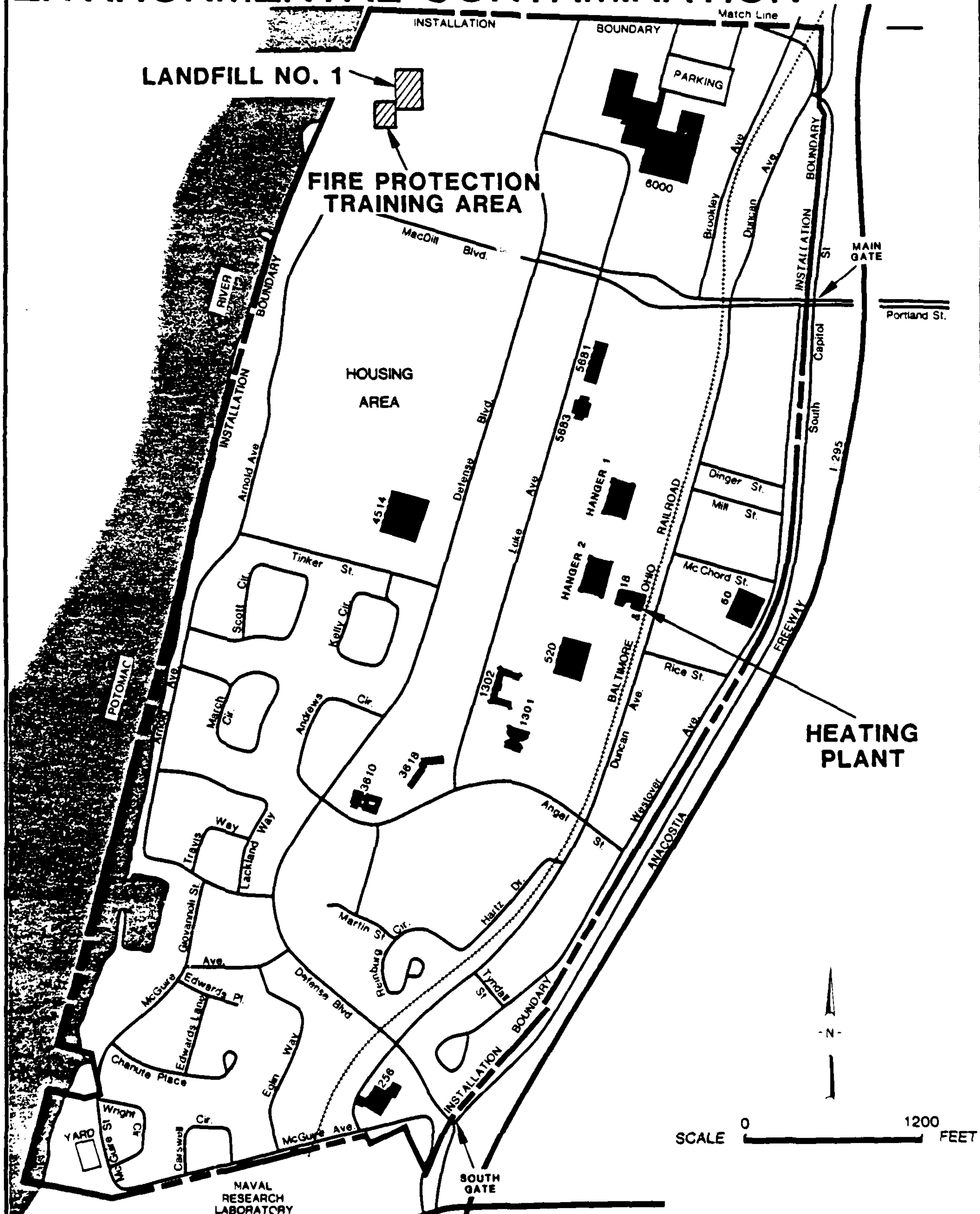
RECOMMENDATIONS

Recommended guidelines for future land use restrictions at the disposal sites are presented in Section 6. A program for proceeding with Phase II and other IRP activities at Bolling AFB is also presented

FIGURE 1

BOLLING AFB

SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION



SOURCE: BOLLING AFB INSTALLATION DOCUMENTS

TABLE 1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
BOLLING AFB

Rank	Site	Operation Period	HARM Score (1)
1	Heating Plant Oil Leak	-	66
2	Fire Protection Training Area	1947-1962	54
3	Landfill No. 1	1970-1980	54

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

in Section 6. The recommended actions include a soil boring, monitoring well, sampling and analysis program to determine if contamination exists. This program may be expanded to define the extent and type of contamination if the initial step reveals contamination. The Phase II recommendations are summarized in Table 2.

TABLE 2
RECOMMENDED MONITORING PROGRAM FOR
PHASE II
BOLLING AFB

Site Name	Rating Score	Recommended Monitoring	Sample Analyses List (1)	Comments
Heating Plant Oil Leak	66	Install and sample 1 upgradient and 3 downgradient wells.	A	If sampling indicates contamination, continue monitoring. Additional wells may be necessary to assess extent of contamination.
Fire Protection (2) Training Area	54	Conduct geophysical survey (electromagnetic conductivity); place one soil boring in approximate center of burn area; install and sample one upgradient and three downgradient wells.	B	If sampling indicates contamination, continue monitoring. Additional wells and soil borings may be necessary to assess extent of contamination.
Landfill No. 1 (2)	54	Conduct geophysical survey (electromagnetic conductivity); install and sample one upgradient and three downgradient wells.	A	If sampling indicates contamination, continue monitoring. Additional wells may be necessary to assess extent of contamination.

(1) See Table 6.2
(2) Phase II confirmation studies may be combined for these sites.

SECTION 1

INTRODUCTION

BACKGROUND AND AUTHORITY

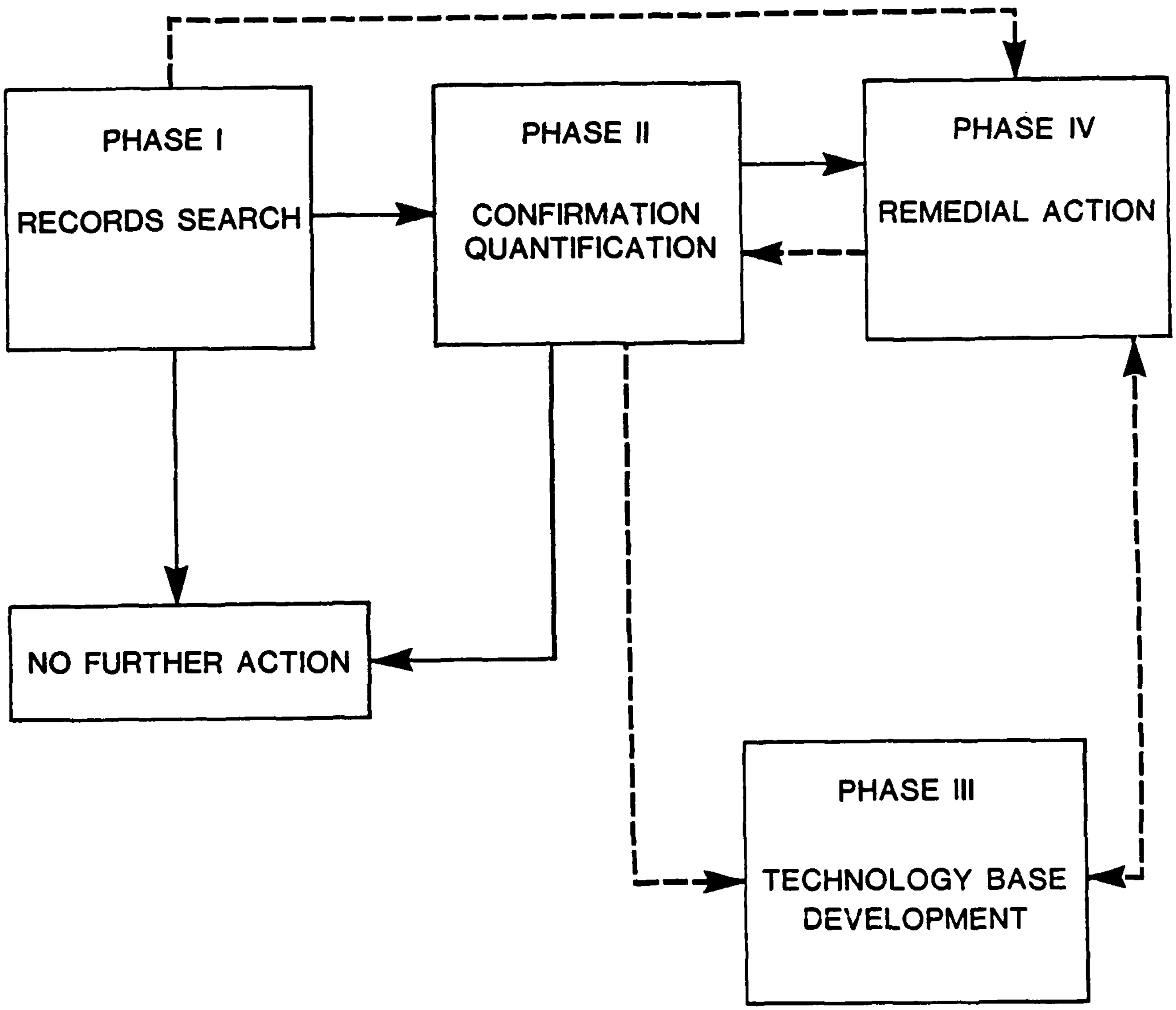
The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites, and Federal agencies are required to make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316. CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites.

PURPOSE AND SCOPE

The Installation Restoration Program is a four-phased program (Figure 1.1) designed to assure that identification, confirmation/quantification, and remedial actions are performed in a timely and cost-effective manner. Each phase is briefly described below:

- Phase I - Installation Assessment/Records Search - The purpose of phase I is to identify and prioritize those past disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or ground waters, or have an adverse effect by its persistence in the environment. In this phase, it is determined whether a site requires further action to confirm an environmental hazard or whether it may be considered to present no hazard at this time. If a site requires immediate remedial action, such as removal of abandoned drums, the action can proceed directly to Phase IV. Phase I is a basic background document for the Phase II study.
- Phase II - Confirmation/Quantification - The purpose of phase II is to define and quantify, by preliminary and comprehensive environmental and/or ecological survey, the presence or absence of contamination, the extent of contamination, waste characterization (when required by the regulatory agency), and to identify sites or locations where remedial action is required in Phase IV. Research requirements identified during this phase will be included in the Phase III effort of the program.
- Phase III - Technology Base Development - The purpose of phase III is to develop a sound data base upon which to prepare a comprehensive remedial action plan. This phase includes implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.
- Phase IV - Remedial Actions - The purpose of phase IV includes the preparation and implementation of the remedial action plan.

U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM



SOURCE: AFESC

ES ENGINEERING - SCIENCE

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Bolling AFB under Contract No. F08637 84 C0070. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommended follow-on actions. The land area included as part of the Bolling AFB study is the 616.5 acre main base site.

The activities performed as a part of the Phase I study scope included the following:

- Review of site records
- Interviews with personnel familiar with past generation and disposal activities
- Survey of types and quantities of wastes generated
- Determination of current and past hazardous waste treatment, storage, and disposal activities
- Description of the environmental setting at the base
- Review of past disposal practices and methods
- Reconnaissance of field conditions
- Collection of pertinent information from federal, state and local agencies
- Assessment of the potential for contaminant migration
- Development of recommendations for follow-on actions

ES performed the on-site portion of the records search during January 28-31, 1985. The following team of professionals was involved:

- C. M. Mangan, Environmental Engineer and Project Manager, 18 years professional experience.
- S. K. Minicucci, Chemical/Environmental Engineer, 4 years professional experience.
- J. R. Absalon, CPG, Hydrogeologist, 12 years professional experience.

More detailed information on these three individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the Bolling AFB Records Search began with a review of past and present industrial operations conducted at the installation. Information was obtained from available records such as shop files and real property files, as well as interviews with past and present base employees from various operating areas. Those interviewed included current and past personnel associated with civil engineering, fuels management, roads and grounds maintenance, fire protection, real property, history, and shop personnel. A listing of interviewee positions with approximate years of service is presented in Appendix B.

Concurrent with the employee interviews, the applicable federal, state and local agencies were contacted for pertinent study area related environmental data. The agencies contacted are listed below, with specific contacts identified in Appendix B.

- U.S. Geological Survey - Water Resources Division
- RCRA Enforcement Section
  U.S. Environmental Protection Agency, Region III
- Federal Facilities Program
  U.S. Environmental Protection Agency, Region III
- Water Quality Branch, District of Columbia Department of Environmental Services.
- Hazardous Waste Management Program, District of Columbia Department of Environmental Services.
- Modern Military Field Branch, Washington National Record Center.
- Cartographic and Architectural Branch, National Archives.
- Modern Military Branch, National Archives.
- Office of Air Force History, Bolling AFB.

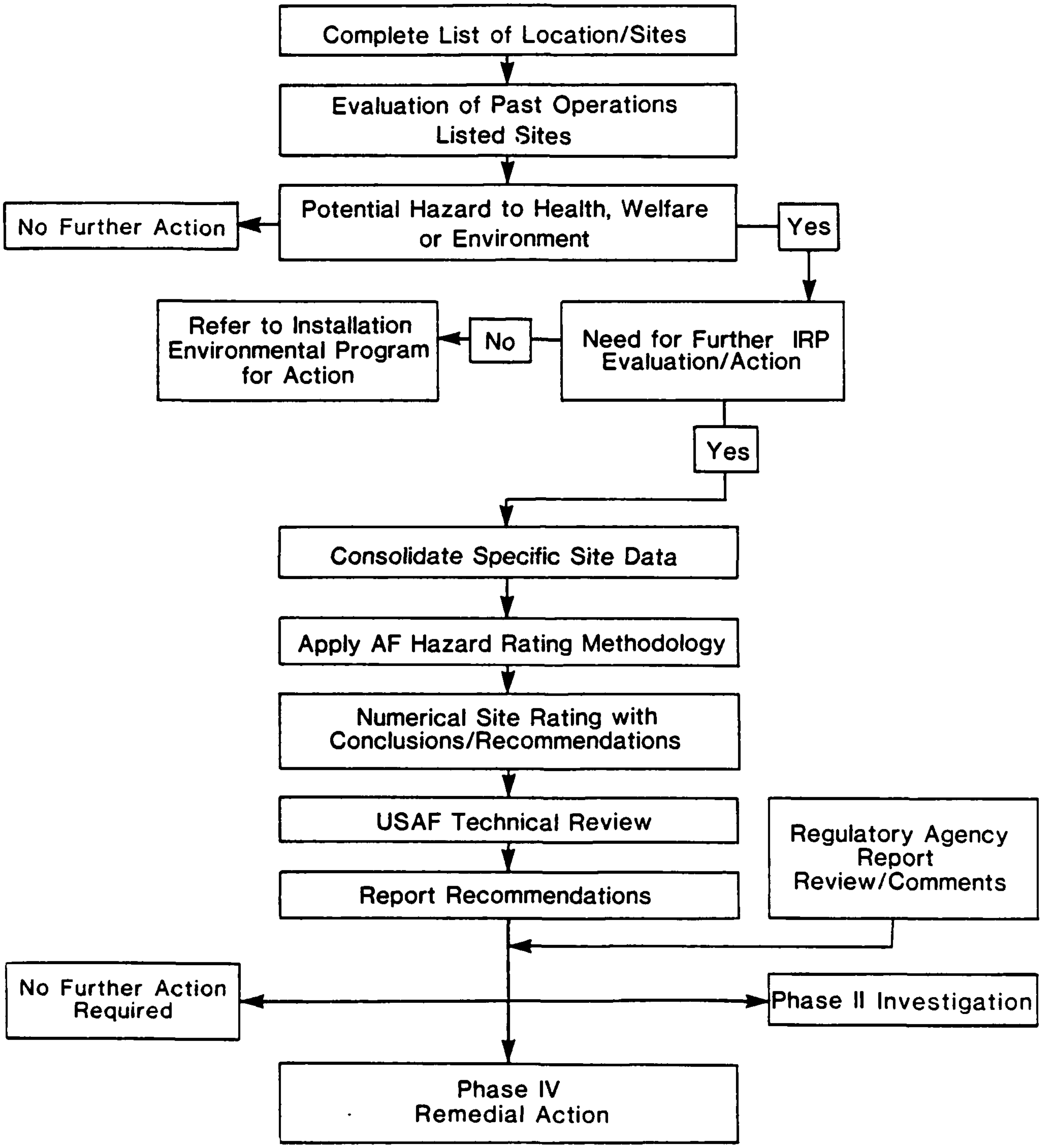
The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources on the base. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

A general ground tour of the identified sites was made by the ES Project Team to gather site-specific information including: (1) general observations of existing site conditions; (2) visual evidence of environmental stress; (3) presence of nearby drainage ditches or surface waters; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential hazard to health, welfare or the environment exists at any of the identified sites using the Flow Chart shown in Figure 1.2. If no potential existed, the site received no further action. For those sites where a potential hazard was identified, a determination of the need for IRP evaluation/action was made by considering site-specific conditions. If no further IRP evaluation was determined necessary, then the site was referred to the installation environmental program for appropriate action. If a site warranted further investigation, it was evaluated and rated using the Hazard Assessment Rating Methodology (HARM). The HARM score is a resource management tool which indicates the relative potential for adverse effects on health or the environment at each site evaluated.

PHASE I INSTALLATION RESTORATION PROGRAM

RECORDS SEARCH FLOW CHART



Source: AFESC

SECTION 2

INSTALLATION DESCRIPTION

LOCATION, SIZE & BOUNDARIES

Bolling AFB is located in southeastern Washington, D.C. at the confluence of the Potomac and Anacostia Rivers (see Figures 2.1 and 2.2). The base is bordered to the west by the Potomac River, to the east by the South Capital Street/I-295 Corridor, and U.S. Navy facilities to the north and south. The area beyond these boundaries is primarily residential. Further south is the Blue Plains Sewage Treatment Plant. The main base site comprises 616.5 acres and is shown in Figure 2.3. North of Bolling AFB is the Anacostia Naval Air Station.

BASE HISTORY

The land area currently occupied by Bolling AFB has been previously utilized in several unique ways. It was formerly the site of an indian village, a calvary supply depot, and a river resort. In 1917, an area just north of the current base property was chosen as a temporary training facility for the Air Service of the Army Signal Corps. This site was officially named Bolling Field in 1918. The Air Service was redesignated as the Army Air Corps in 1926.

In 1930, approximately 500 acres of land south of the original Bolling Field was purchased for construction of a new, larger airfield by the Army Air Corps. This new land area had formerly been used and owned by the Washington Steel and Ordnance Company (National Park Service, 1984). The new field was completed in 1937, by 1940 all units had transferred to this site and the old airfield was turned over to the Navy.

Bolling Field was used as an air training center, a transport base, and an aerial defense facility during the two World Wars. The field also served as an experimental station for many aircraft considered for use by the military or federal government.

FIGURE 2.1

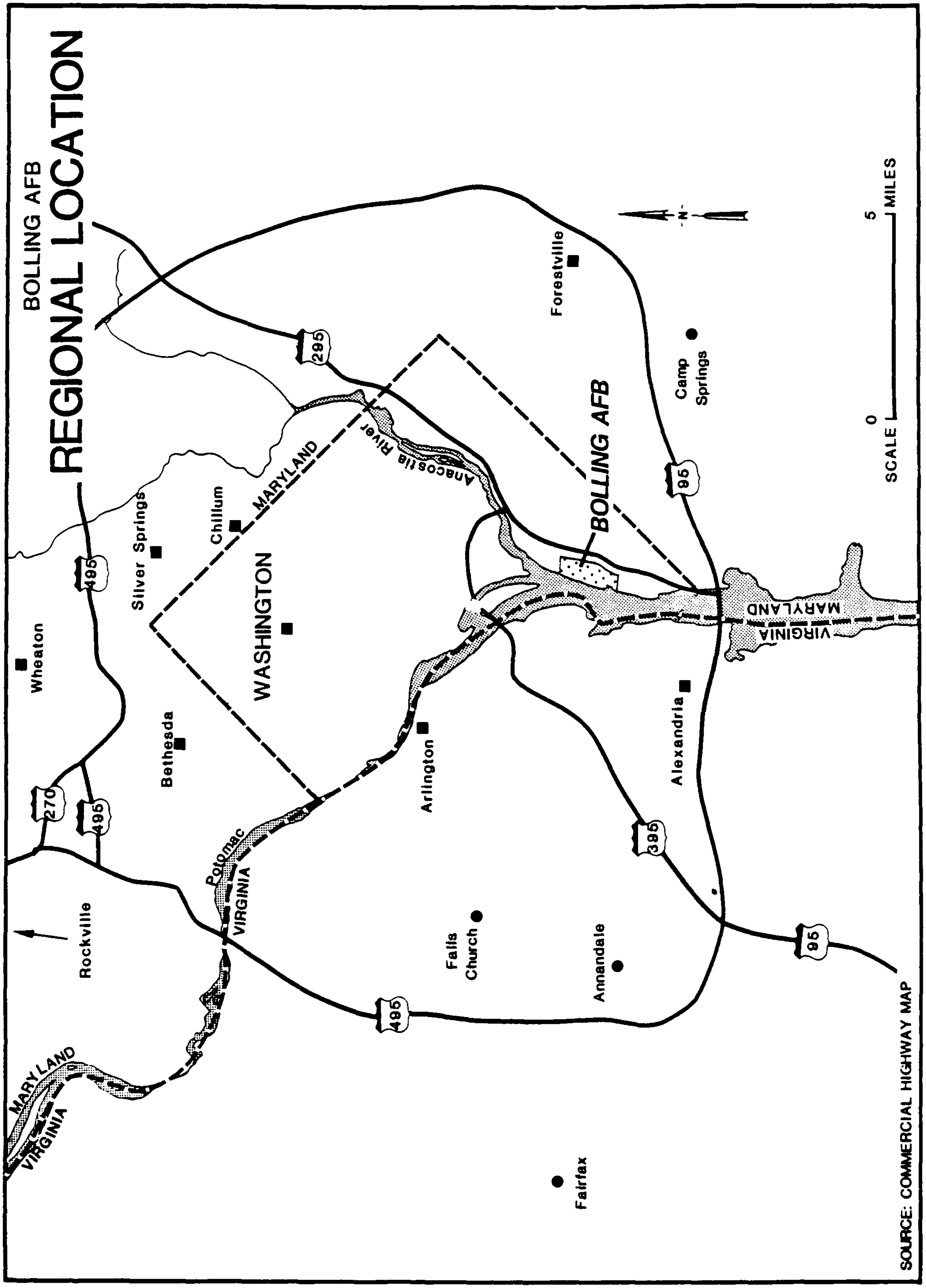
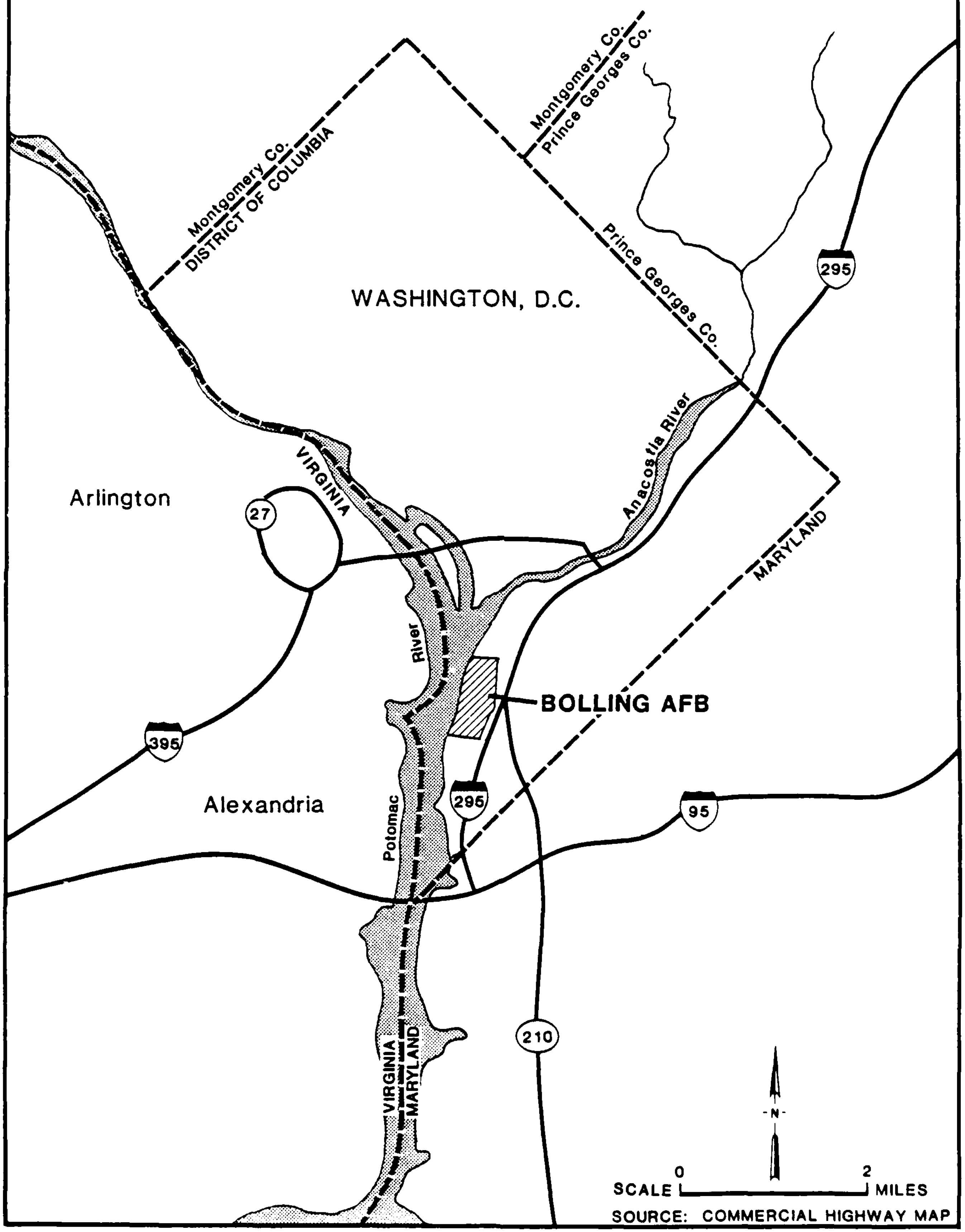

BOLLING AFB
REGIONAL LOCATION
Wheaton
Silver Springs
Chillum
Bethesda
Rockville
WASHINGTON
MARYLAND
VIRGINIA
Potomac
Anacostia River
BOLLING AFB
Arlington
Falls Church
Annandale
Alexandria
Fairfax
Forestville
Camp Springs
295
495
270
95
395
N
SCALE
0
5
MILES
SOURCE: COMMERCIAL HIGHWAY MAP

FIGURE 2.2

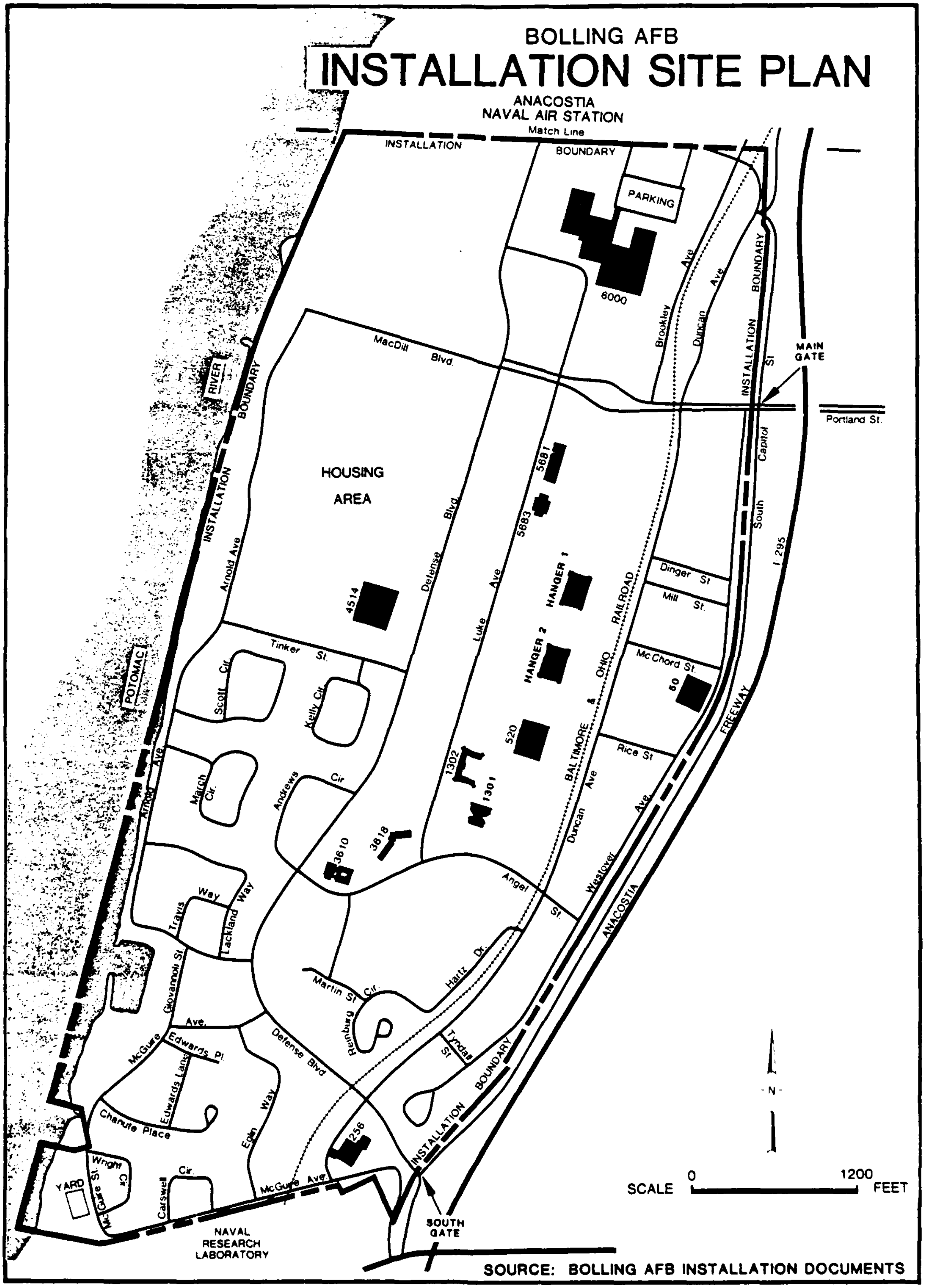
BOLLING AFB

AREA LOCATION MAP



SOURCE: COMMERCIAL HIGHWAY MAP

ES ENGINEERING-SCIENCE



ES ENGINEERING-SCIENCE

When World War II was over, Bolling Field was assigned to the Strategic Air Command (SAC), however, in 1946 SAC transferred to Andrews Field. Bolling Field Command was established as a separate command at this time. In 1948, this command was redesignated Headquarters Command, USAF and the site was renamed Bolling Air Force Base.

Forty-four years of major aviation activity ended in 1962 when all fixed-wing aircraft operations were transferred to Andrews AFB. Since that time, there have been significant alterations at the base. Extensive housing and administrative facilities have been constructed in the western portion of the base. Portions of the runways were covered with fill to raise the elevation an average of 6 feet to minimize the potential for future flooding. These changes have been made to adapt the base to fulfill the needs of its current mission.

ORGANIZATION AND MISSION

Bolling AFB is currently used as an administrative and personnel support center for overall Air Force activities in the National Capital Region (NCR). The host unit at the base is the 1100th Air Base Wing. This wing is responsible for the overall operation of the base and for providing administrative and logistical support to Air Force units assigned or attached to the base. They are also responsible for providing facilities and service support to tenants at the base. The wing administers housing, and welfare for armed forces personnel in the eastern half of the Washington area. The U.S. Air Force Honor Guard, an assigned unit to the wing, provides ceremonial support for military and state functions in the area.

The major tenant organizations at Bolling AFB are listed below. Descriptions of the major tenant organizations and their missions are presented in Appendix C.

Detachment 1, 1500 Computer Services Squadron
Detachment 4, 1361 Audiovisual Squadron
Detachment 1, 2045 Information Systems Group
Office of Air Force History
Directorate of Administration
Office of the Chief of Chaplains

General Purpose Threat Division

Strategic Studies Division

USAF Trial Judiciary, First Circuit

USAF, Directorate of Engineering & Services

USAF Office of the Surgeon General

Washington Area ADP Support Office

Air Force Civilian Appellate Agency

Bolling AFB Commissary

Headquarters Air Force Element/Technical Assistance Group

Directorate of Soviet Affairs

Directorate of Intelligence Data Management

Directorate of Target Intelligence

Air Force Office of Special Investigations

Detachment 411, Air Force Office of Special Investigations

Air Force Office of Scientific Research

Air Reservist Magazine

USAF-Civil Air Patrol National Capital Wing Liaison Office

SECTION 3

ENVIRONMENTAL SETTING

The environmental setting of Bolling Air Force Base is described in this section with the primary emphasis directed toward the identification of features or conditions that may facilitate the generation and migration of hazardous waste related contamination off-base. Environmentally sensitive conditions pertinent to this study are summarized at the end of this section.

CLIMATE

Temperature, precipitation, snowfall and other relevant climatic data furnished by Detachment 1, 15th Weather Squadron, Andrews Air Force Base, MD are listed on Table 3.1. The period of record is 38 years. The summarized data indicate that mean annual precipitation is 42.6 inches. Net annual precipitation is calculated to be 5.6 inches, based on National Oceanographic and Atmospheric Administration data (NOAA, 1983). The net precipitation is an estimate of the amount of meteoric water potentially available for infiltration into the subsurface and does not consider evapotranspiration, which varies seasonally. The infiltration potential for Bolling AFB is moderate. The one-year, twenty-four hour rainfall value for the study area is reported to be approximately three inches (U.S. Department of Commerce, Weather Bureau, 1961). This figure suggests that a moderate potential for the development of erosion exists.

The study area experiences a continental-type of climatic pattern with warm, humid summers and relatively mild winters. The warmest months are June to August; the coldest include December through February. Precipitation occurs with regularity; most rainfall occurs during the late spring and summer months of May through September.

TABLE 3.1
BOLLING AFB CLIMATOLOGICAL DATA

MONTH	Temperature (°F)					Precipitation (In)				Snowfall (In)			Wind	
	Mean			Extreme		Monthly			Max	Monthly		Max	Mean	Prevailing
	Daily Max	Daily Min	Monthly	Max	Min	Mean	Max	Min	24 Hrs	Mean	Max	24 Hrs	Speed (kts)	Direction
JAN	42	27	35	77	-3	3.2	8.0	.3	2.3	6	27	10	7	NW
FEB	44	28	36	80	-4	2.7	6.7	.4	1.7	6	31	14	8	NW
MAR	53	36	45	87	10	3.7	6.6	1.1	2.0	4	28	13	8	NW
APR	65	45	55	96	23	2.9	7.2	1.0	2.7	#	3	3	8	NW
MAY	74	54	64	96	33	4.0	11.3	1.0	3.1	#	#	#	6	S
JUN	82	63	72	100	42	3.6	10.5	.6	3.9	0	0	0	6	S
JUL	86	68	77	102	48	4.4	14.3	.6	4.3	0	0	0	5	S
AUG	84	67	76	100	48	4.5	14.2	.4	7.1	0	0	0	4	S
SEP	78	60	69	100	38	3.7	12.6	.6	7.2	0	0	0	5	S
OCT	67	49	58	92	28	3.3	7.5	#	3.0	#	4	4	6	W
NOV	56	39	48	84	13	3.2	7.1	.2	3.1	1	11	11	7	NW
DEC	45	30	38	75	7	3.4	6.9	.5	3.0	4	18	10	8	NW
ANN	65	47	56	102	-4	42.6	14.3	#	7.2	21	31	14	6	NW
EYR	38	38	38	38	38	38	38	38	38	35	35	35	10	10

Note: # indicates trace accumulations.

Period of Record: 1943 - 1981

Source: Detachment 1, 15th Weather Squadron, Andrews AFB, MD

EYR: Years of Record

ANN: Annual Average

Surface wind directions favor the northwest during the winter and fall seasons and tend to prevail in a southerly direction during the spring and summer seasons.

GEOGRAPHY

The study area lies within the Inner Coastal Plain subdivision of the Atlantic Coastal Plain Physiographic Province, south east of the Fall Line (Otton, 1970). The Fall Line is an arbitrary zone of delineation (not a distinct line as the term implies), ten to thirty miles wide marking the boundary between the Piedmont Province inland and the Coastal Plain. Study area terrain consists of well dissected uplands and rolling hills underlain by unconsolidated Coastal Plain deposits. Prominent surface features include rounded hills, terraces, widely separated interstream divides and well defined stream valleys with steep walls. Local relief is usually the result of erosional activity or stream channel development. Bolling AFB is located in the generally level Potomac River floodplain. The installation is bordered on the west by the Potomac River and on the east by the river valley wall. Study area physiographic divisions are shown on Figure 3.1.

Topography

The land surface at Bolling Air Force Base appears to be generally level with little spatial variation. Base surface elevations range from 70 feet, National Geodetic Vertical Datum of 1929 (NGVD) at the intersection of Defense Boulevard and Overlook Avenue, to 5 feet, NGVD along the Potomac River bank near Building 850. The greatest relief evident on base is approximately ten feet which occurs along the banks of the Potomac River.

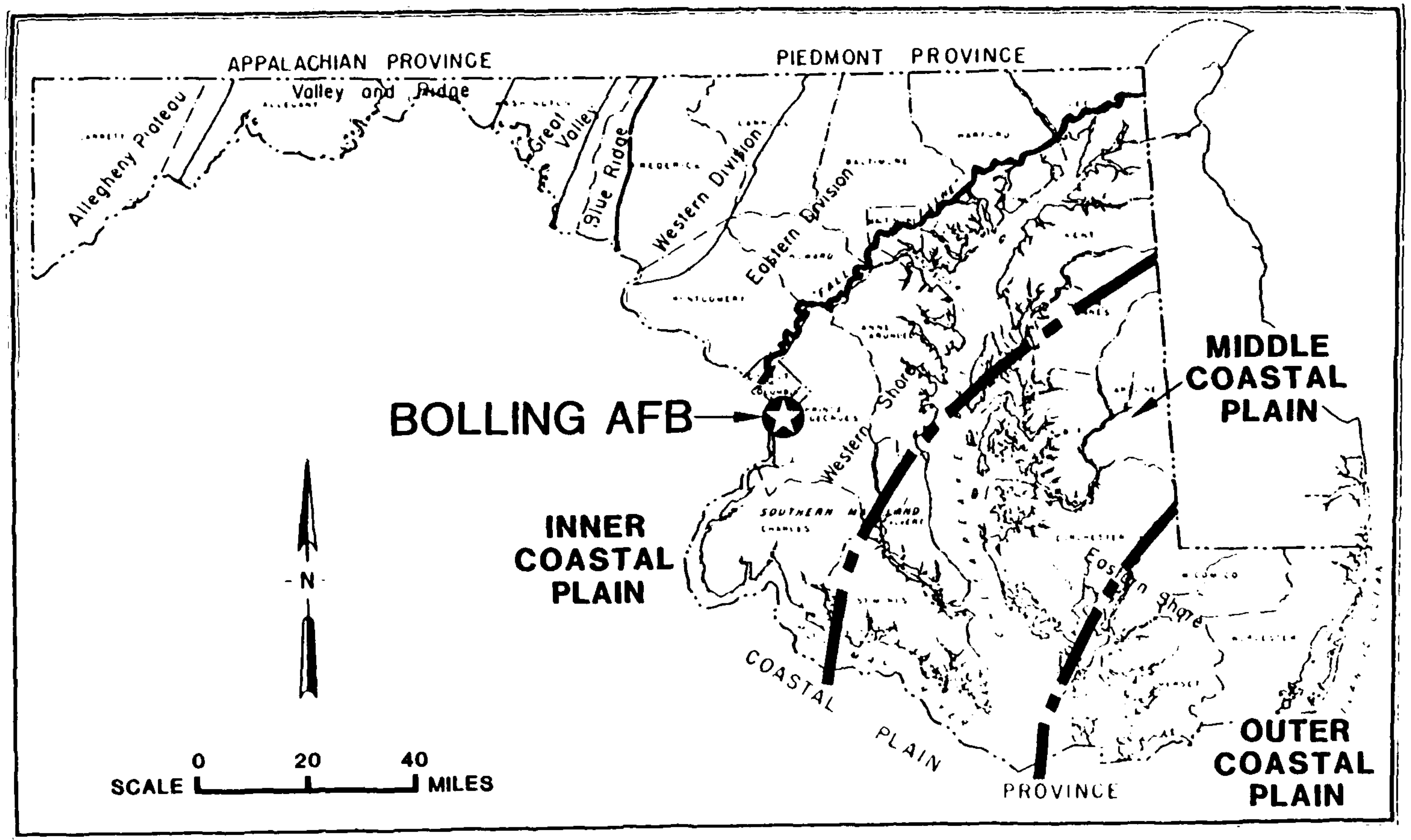
Drainage

The drainage of installation land areas is accomplished by overland flow to catch basins and storm sewers leading to the Potomac River. There are no surface waters or wetlands on base. Flooding is not known to be a problem at Bolling AFB. Drainage features for the base are depicted on Figure 3.2.

FIGURE 3.1

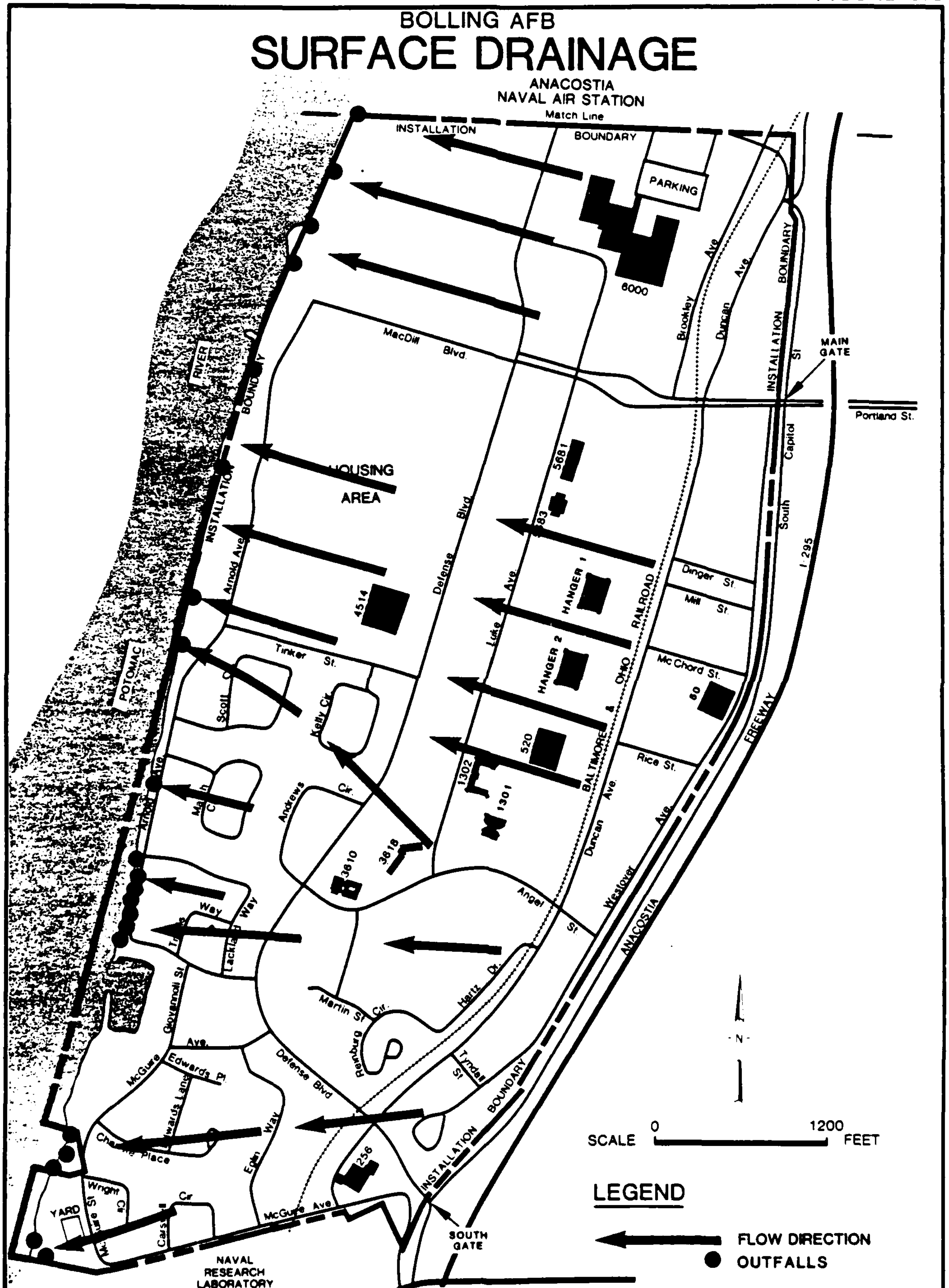
BOLLING AFB

STUDY AREA PHYSIOGRAPHIC DIVISIONS



SOURCE: MODIFIED FROM OTTON, 1970 AND VOKES AND EDWARDS, 1957, REVISED 1974

FIGURE 3.2



SOURCE: MODIFIED FROM BOLLING AFB INSTALLATION DOCUMENTS

Surface Soils

The surface soils of the Washington, D.C. area have been mapped in detail by the USDA, Soil Conservation Service (report undated). Two principal soils associations have been mapped on base; their distribution is shown on Figure 3.3. The base lowland area (about ninety per cent of the installation) is dominated by the Udorthents Association. These soils are essentially man-made fills occurring as nearly level to steep zones adjacent to existing waterways or in former low areas. They are moderately deep to deep well-drained materials. They are rated as generally poor for development due to stability limitations. Their textures and physical characteristics are highly variable due to the nature of their development. Fill materials commonly consist of mixed sand, silt, clay, gravel, miscellaneous debris or construction rubble, etc. The principal use of this soil association is to provide a level surface above wet or flood-prone areas on which to build permanent structures. These soils will generally not facilitate the growth of woody plants nor do they support the development of wildlife habitats.

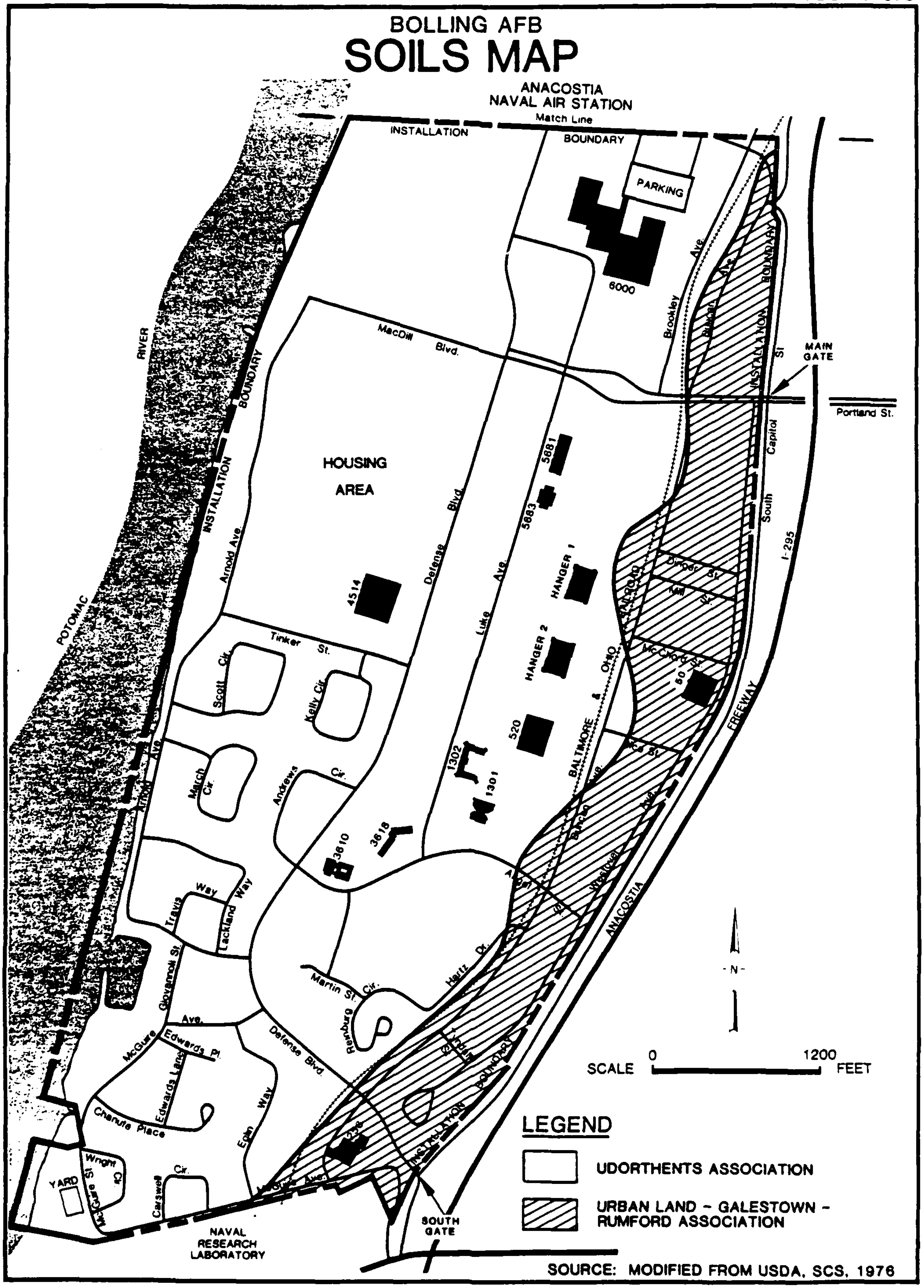
The base upland area is dominated by the Urban Land-Galestown-Rumford Association. This soils association occurs as a relatively narrow band of nearly level to sloping sandy soils on the Potomac and Anacostia River terraces. These are deep, excessively drained materials that have been altered locally to permit construction or various site use modifications. Their physical characteristics are highly variable.

A significant proportion of the installation's surface soils have been covered as a result of building construction and paving.

GEOLOGY

Information describing the geology of the Bolling Air Force Base study has been reported by the following sources:

- Johnston, 1964
- U.S. Geological Survey, 1967
- Cleaves, et al., 1968
- Froelich, 1975a and 1975b



ES ENGINEERING-SCIENCE

Additional information has been obtained from installation construction test boring logs. A brief overview of the available information with pertinent comments is included in the following discussion.

Stratigraphy and Distribution

Bolling Air Force Base is located within the District of Columbia, just southeast of the Fall Line. In this area, geologic units ranging from Pre-Cambrian/Paleozoic consolidated rocks to recent unconsolidated materials have been identified. The consolidated rocks include the Wissahickon schist and gneiss, the Georgetown igneous group and the Kensington gneiss. These crystalline rocks form a basement or floor on which the younger Coastal Plain sediments have accumulated. The coastal plain sediments include Cretaceous, Tertiary and Quaternary units composed of sand, gravel, silt and clay, fossils, decayed vegetation, occasionally glauconitic and carbonaceous. Study geologic units are summarized on Table 3.2.

The site-specific geology of Bolling AFB consists primarily of three unconsolidated units: Quaternary alluvium (Qal); Pleistocene river terrace deposits (Qt) and the Cretaceous clay and silt facies of the Potomac Group (Kpc). The distribution of these units is shown on Figure 3.4, a geologic map of Bolling AFB.

The Quaternary alluvium (Qal) underlies most of the installation and commonly occurs along the Potomac and Anacostia River margins in the study area. It occupies the lowest topographic position and has the appearance of a generally level surface. The alluvium consists of soft organic silt and clay with vegetation, granular silt, clay, sand and gravel. The unit varies in thickness from a few inches at the toe of the river terrace adjacent to the railroad track alignment to more than eighty feet along the rivers edge. A review of installation test boring data indicates that in some areas, the alluvium is overlain by as much as twenty feet of fill. The fill, consisting of sand, silt, clay, gravel, bricks, ashes, cinders, etc. was placed in low or wet sections of the base to provide a stable surface above potential flood limits on which to develop base facilities.

The River Terrace deposits (Qt) are present along the slopes between the lowest sections of the base and the uplands. This unit appears on the Study Area Geologic Map (Figure 3.4) as a linear feature parallel

TABLE 3.2
WASHINGTON, D.C. GEOLOGIC UNITS

UNCONSOLIDATED MATERIALS
(Mainly Coastal Plain sediments)

(Queried where uncertain - ?)

QUATERNARY

RECENT

af

Artificial fill

Local unconsolidated material from nearby cuts and river dredgings, includes sanitary landfill.

Qal

Alluvium and artificial fill

Gravel, sand, silt, and clay of lowest stream terraces and bottoms, only larger deposits shown. Thickness of a few inches to 25 feet or more. Many large areas of fill, especially along Potomac River and Anacostia River.

Unconformity

PLIOCENE (?) & PLEISTOCENE

Qt

River terrace deposits

Gravel, sand, and loam, basal part is generally unsorted boulders, pebbles, and sand, locally contains plant fossils and peat beds. Average thickness of 30 feet, occurs at various levels.

Unconformity

TERTIARY

MIOCENE (?) & PLIOCENE (?)

Tug

Upland gravel and sand

Gravel and sand in orange loam matrix, capping remnants of former plateau. Coarse material at base. Gravel largely quartzite, some vein quartz, crystalline rock fragments, and chert. Average thickness 30 feet. Deposited by ancestral Potomac River.

Unconformity

MIOCENE

Tc

Calvert Formation

Very fine sand mixed with clay. Compact, dark gray to green where fresh, weathered outcroos are soft gray or buff sand. Thickness of 20 to 80 feet. In places contains shells and impressions, bone fragments, shark teeth, fish scales, and remains and impressions of plants.

Unconformity

PALEOCENE

Ta

Aquia Formation

Where fresh, bluish- or greenish-black, moderately fine sand mixed with clay greensand (glauconite), organic matter, and chalky white marine fossil shells. Weathered material is gray, buff, or reddish-brown sand, with ironstone concretions in places. Thickness less than 50 feet.

MESOZOIC

Unconformity

UPPER CRETACEOUS

Km

Monmouth Formation

Dark micaceous sand with considerable greensand (glauconite). Weathers to brown sand with limonite cemented crusts and concretions. In places contains marine shells or impressions, mostly mollusks. Thickness of as much as 50 feet.

Unconformity

LOWER & UPPER CRETACEOUS

Kpc / Kps

Potomac Group

Kpc - clay and silt facies   Kps - sand and gravel facies

Kpc-beds in eastern part of area are chiefly pink, red, and gray silty clay with interbedded irregular sand and gravel lenses that in places grade into clay. Contains fossil bones, plant remains, and lignite. Kps-basal part in western part of District is gravel, sand, and arkose with occasional sandy clay lenses generally light gray in color. This unit overlies crystalline rocks. Thickness of total Potomac Group increases to the east, where it exceeds 700 feet

CONSOLIDATED ROCKS AND WEATHERED RESIDUUM
(Mainly Piedmont crystalline rocks and saprolite)

(Queried where uncertain - ?)

PRECAMBRIAN, LOWER PALEOZOIC, OR BOTH

Kg

Kensington gneiss

Medium to coarse, crystalline, light gray, layered to nearly massive, jointed quartz diorite gneiss consisting of quartz, feldspar, and mica, overlain on valley slopes and uplands by grayish-brown, soft, weathered, sandy and silty, well drained saprolite residuum as much as 120 feet thick.

Gm / U

Georgetown mafic complex

Mixed group of metaigneous and metavolcanic rocks consisting of fine to coarse-crystalline, dark gray green to black, foliated to massive, jointed gabbro, tonalite, diorite, amphibolite, and chloritic schist. The predominant minerals are amphibole, chlorite, plagioclase feldspars, and mica, overlain by 10 to 50 feet of red brown, ferruginous, poorly drained, clay-rich saprolite.

U - Ultramafic rocks, chiefly serpentinite, talc schist, and chlorite schist with little or no saprolite on weathered, dark green rock.

GLENARM SERIES

Wp   Wd

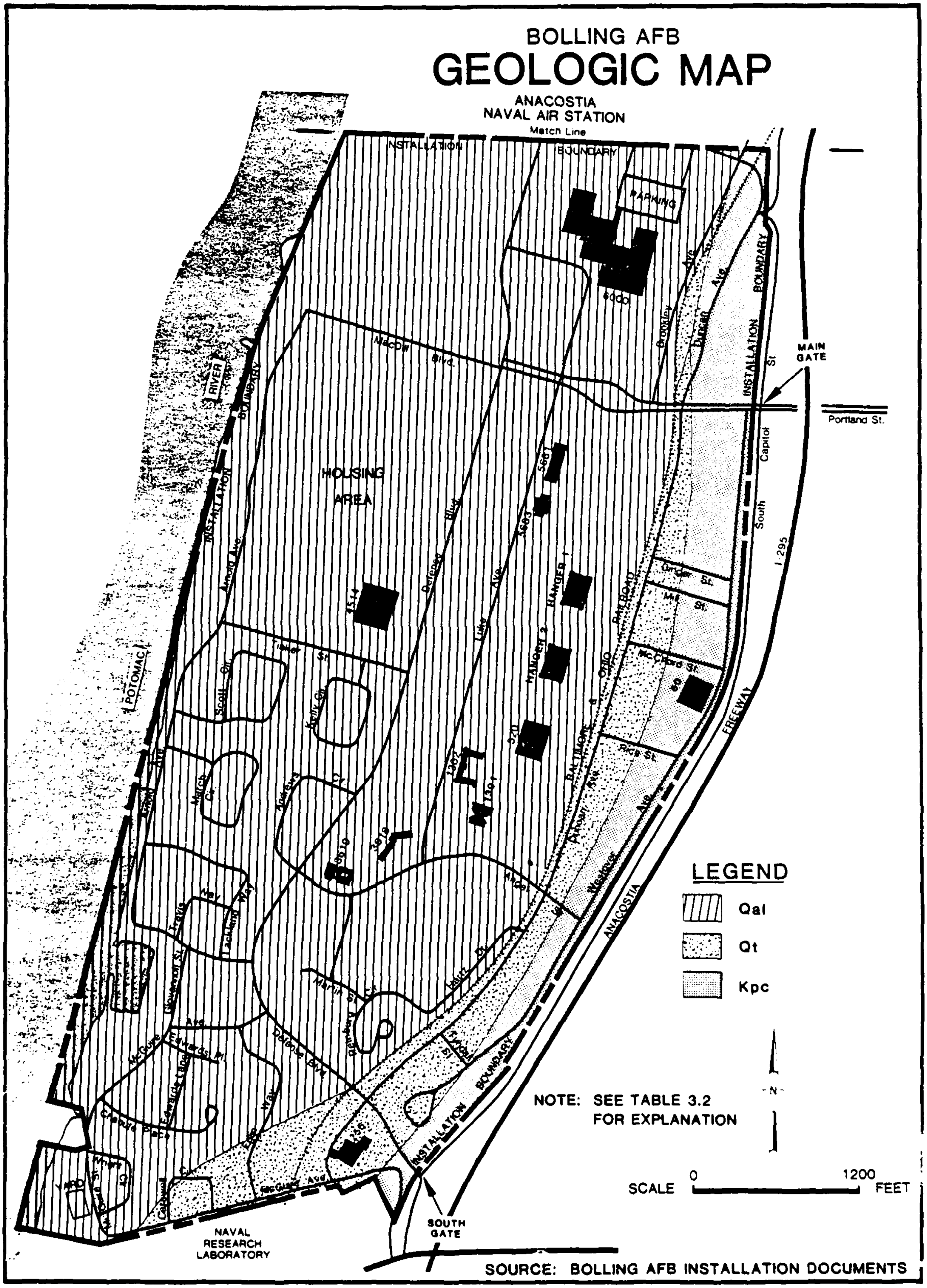
Wissahickon Formation

Wp - pelitic schist facies   Wd - diamictite gneiss facies

Wp - Fine to coarse crystalline, foliated quartz-mica schist and chlorite quartz schist with fine garnets, overlain on uplands by reddish brown, soft, micaceous, silty, well drained saprolite residuum as much as 160 feet thick.

Wd - Medium to coarse crystalline, layered to massive, jointed quartz feldspar biotite gneiss with scattered quartz pods and schist and amphibolite cobbles overlain by sandy, reddish brown, well drained saprolite as much as 120 feet thick on uplands but less than 25 feet thick where overlain by Coastal Plain strata.

Source: Froelich, 1975b


BOLLING AFB
GEOLOGIC MAP
ANACOSTIA
NAVAL AIR STATION
Match Line
INSTALLATION BOUNDARY
PARKING
MAIN GATE
Portland St.
HOUSING AREA
POTOMAC
RIVER
South Capitol St
I-295
FREEWAY
ANACOSTIA
BALTIMORE & OHIO RAILROAD
HANGER 1
HANGER 2
NAVAL RESEARCH LABORATORY
SOUTH GATE
LEGEND
Qal
Qt
Kpc
NOTE: SEE TABLE 3.2 FOR EXPLANATION
N
SCALE 0 1200 FEET
SOURCE: BOLLING AFB INSTALLATION DOCUMENTS

to the Potomac River. It consists of sand, gravel, silt and clay; peat (decomposed vegetation) may occur locally. Its lower extent may include cobbles and boulders. The Terrace Deposits are reported to reach a maximum thickness of some thirty feet in the study area.

The clay and silt facies of the Cretaceous Potomac Group (Kpc) occupies the highest elevations at the base along the alignment of the Anacostia Freeway. This unit occurs on many of the study area uplands and consists of multi-colored silty clay interbedded with sand and gravel lenses. The Potomac Group reaches a maximum reported thickness of some 700 feet and directly overlies the crystalline rock basement.

Structure

The Coastal Plain sediments form a southeast dipping wedge, with a point of origin at the Fall Line in Washington, D.C. (refer to Figure 3.1) and thicken to the southeast (seaward). At the Fall Line, sediment thickness may be measured in inches; however at the coast, their total accumulation is several thousand feet. Data published by Froelich (1975a) suggests that Coastal Plain sediments are on the order of 450 feet thick in the Bolling AFB area. The bedding of the coastal Plain geologic units strikes northeast-southwest and the dip is generally southeast at low angles, usually less than one degree (Glaser, 1971). The geologic units present on base are not known to be disrupted by faulting or other geologic discontinuities in the immediate base area. Locally, however, unit contacts may be obscured or portions of some units may have been removed, buried or altered due to many years of extensive site use modifications.

HYDROLOGY

Study area hydrology has been described in the following published reports:

- Johnston, et al., 1964
- Back, 1966
- Brown, et al., 1972
- Papadopulos, et al., 1974

Additional information has been obtained from an interview with a U.S. Geological Survey Water Resources Division scientist.

Ground-Water Resources

Bolling Air Force Base is located in a section of the Inner Coastal Plain where several minor and regional aquifers exist. Three hydrogeologic units of particular interest are present at Bolling AFB and correspond to those described in the previous section, GEOLOGY. They include the following:

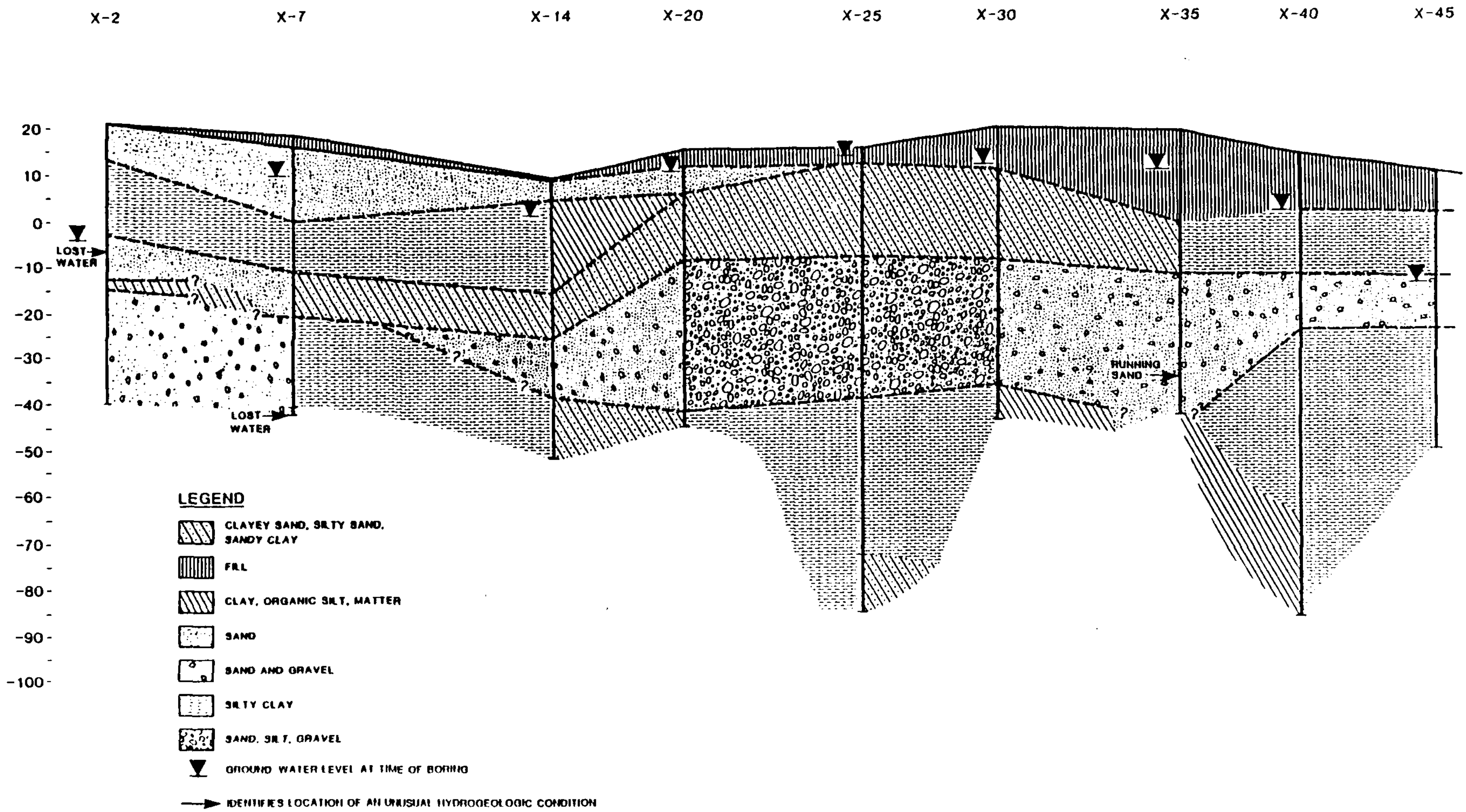
- o Quaternary Alluvium
- o River Terrace Deposits
- o Potomac Group

The Quaternary alluvium consists of silt, clay, sand, minor amounts of gravel and thick accumulations of organic silt and clay. The alluvial deposits occur as relatively low-set and level areas proximate to the Potomac and Anacostia Rivers as well as a few of the region's minor water courses. The granular materials are deposited as a result of stream-channel development and the thick organic deposits accumulate in zones where water movement is minimal. At Bolling AFB the alluvium is the uppermost hydrogeologic unit. In some areas of the base, the alluvium is overlain by construction-related fill, ranging in thickness from two to twenty feet. The alluvium and fill probably act together as an "uppermost aquifer" where they both occur. The alluvium (or alluvium plus fill) is recharged by precipitation falling on its exposed areas or by adjacent surface waters. Ground water most likely occurs in this unit under water table (unconfined) conditions; discharge would most reasonably be expected toward the nearest surface water. The alluvium provides baseflow to the Potomac River. Installation test boring records indicate that ground water is present in this unit at depths ranging from 1.6 to 20 feet below grade (see Figures 3.5 and 3.6). The Potomac River level probably influences base ground-water elevations. The test boring records also indicate that perched water may occur in the thicker fill zones, above the alluvium. This condition is entirely dependent on climatic factors, river height and local geology.

FIGURE 3.5

BOLLING AFB

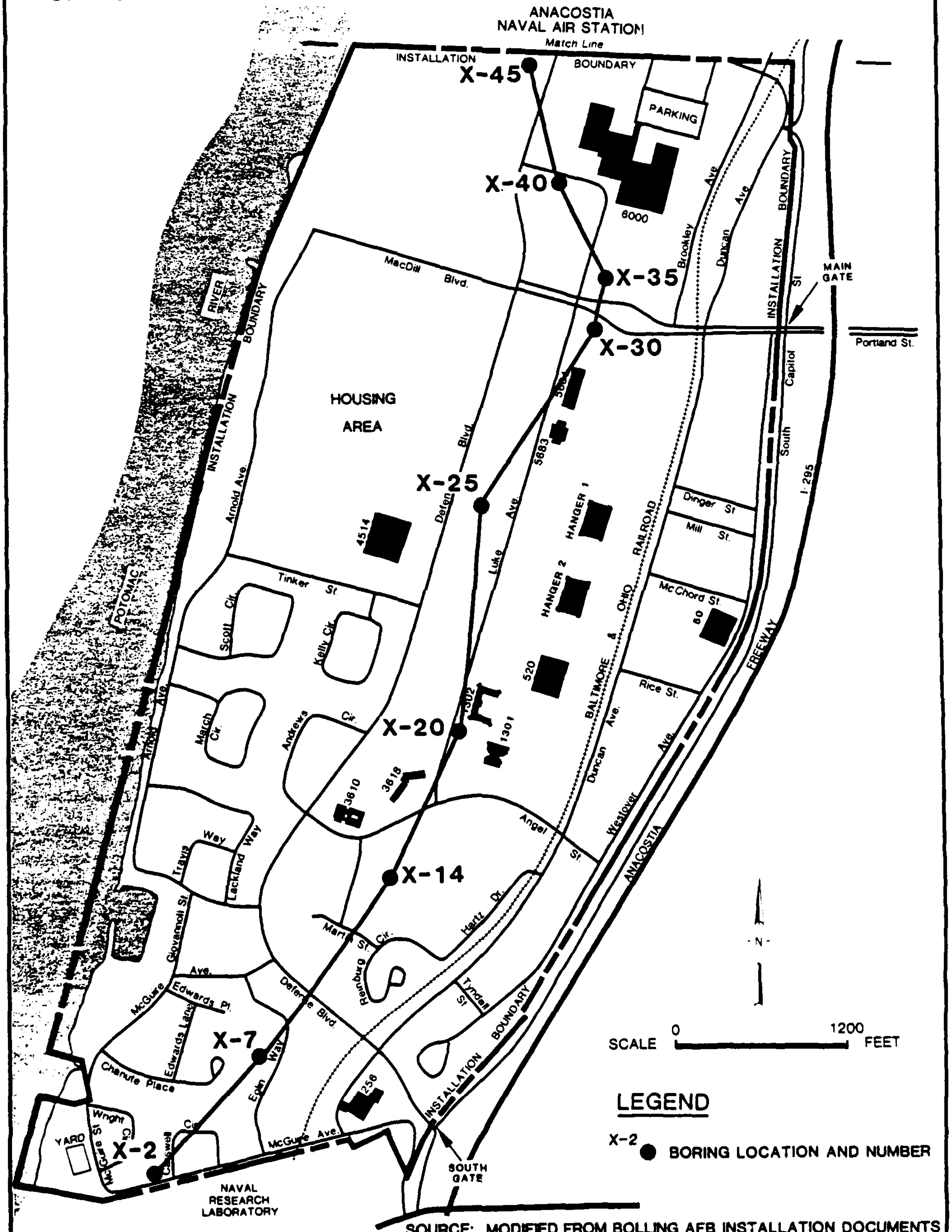
GENERALIZED GEOLOGIC CROSS-SECTION



NOTE: CROSS-SECTION LOCATION SHOWN ON FIGURE 3.6.
SOURCE: ADAPTED FROM INSTALLATION TEST BORING INFORMATION

FIGURE 3.6

BOLLING AFB
GEOLOGIC CROSS-SECTION LOCATION



LEGEND

X-2 ● BORING LOCATION AND NUMBER

SOURCE: MODIFIED FROM BOLLING AFB INSTALLATION DOCUMENTS

ES ENGINEERING-SCIENCE

The River Terrace deposits form a minor water-bearing unit at Bolling AFB. These deposits consist of granular materials with local accumulations of peat. The distribution of this unit is limited to the slopes between the alluvium and the upland sections of the base. The River Terrace deposits are essentially sandy and probably receive recharge from precipitation readily, where exposed. Ground water would be expected to occur in this unit under water table (unconfined) conditions. Installation test borings indicate that the water level ranges from eight to sixteen feet in this unit. Discharge to topographically lower water-bearing units or to local surface waters would be expected.

The Potomac Group clay and silt facies occurs along the highest elevations at Bolling AFB, adjacent to the Anacostia Freeway. This unit consists of primarily fine-grained materials with interbedded sand and gravel lenses locally. It is probably recharged by precipitation; discharge is most likely directed to water-bearing units present at topographically lower positions. Installation test borings advanced in locations where this unit has been mapped indicate that ground water may be present in the unit at depths ranging from 5.8 to 21.2 feet below ground surface. The unit is probably a very minor water-bearing unit in the study area due to its limited distribution and its clay content which restricts the movement of water into, through and from the clay and silt facies.

The base is located in what appears to be the probable recharge zones of all three water-bearing units identified in the study area. Because of the high proportion of land area covered by pavement, building or other site improvements, little recharge would be expected to occur at Bolling AFB.

SURFACE WATER RESOURCES

Bolling Air Force Base occupies a topographically low position in the Potomac River valley. Because of this physical setting, all runoff is directed to the Potomac River, which forms the west installation boundary.

The segment of the Potomac River receiving drainage from Bolling AFB, Hains Point to the Prince Georges County line, have been assigned the following Beneficial Use Classes and Standards (DES, 1982):

- Secondary contact recreation and aesthetic uses (B)
- Propagation of aquatic life and wildlife (C)
- Industrial raw water supply (E)
- Navigational use (F)

Surface Water Quality Monitoring

No surface water quality monitoring is performed at Bolling AFB as there are no surface waters present on the installation and all sewage and industrial water discharges are directed to the municipal treatment system for proper management.

THREATENED AND ENDANGERED SPECIES

The land area of Bolling AFB includes 616.5 acres, all of which has been developed to accomodate installation facilities. There are no open fields or woodlands on the base. The Potomac River shoreline of the base has been either filled or improved as a part of past site development activities. Consequently, there are no special or unique areas on base that might offer habitat to resident threatened or endangered species of plants or animals. Because of the lack of suitable habitats at the base, it is also unlikely that transient threatened or endangered animal species would be present at any time.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate that the following elements are relevant to the evaluation of past hazardous waste management practices at Bolling Air Force Base:

- The mean annual precipitation is 42.6 inches and net annual precipitation is calculated to be 5.6 inches.
- Flooding is not known to be a problem at the base.
- Base surface soils are primarily fill materials. Their infiltration rates and permeabilities are highly variable. Surface soils present in the narrow band of upland on the eastern

portion of the installation are sandy and probably have higher permeability rates. Much of the base has been developed; building construction and pavement covers a significant portion of the land surface.

- A shallow aquifer, consisting of alluvium or alluvium and fill materials exists on base and is present at or near ground surface. Water levels within this unit range from five to twenty feet below grade. This aquifer is assumed to be in hydraulic communication with the Potomac River. The base is located in the recharge zone of the aquifer.
- Two minor shallow water-bearing units occupy areas of limited extent in the highland section of the base. Little is known of their characteristics; test borings indicate shallow water levels. These units are assumed to direct discharge to the alluvium or similar units occurring at lower topographic positions. Part of the installation is located in what appears to be the recharge area(s) of these units.
- None of the water-bearing units identified in the study area are known to be utilized as a source of water supplies. The installation and adjacent consumers obtain water supplies from the municipal water distribution system.
- No threatened or endangered species of plants or animals are known to either reside on base or to be transients in the study area.

It may be seen from these key elements that potential pathways facilitating the migration of hazardous-waste related contamination exist. Contaminants present at land surface have little opportunity to infiltrate into the subsurface, as much of the base land areas have been built up or paved. Other contaminants are likely to be directed into the installation surface drainage system and to be discharged directly to the Potomac River. Materials lost into the subsurface environment from leaking underground storage tanks would encounter the alluvial/fill shallow aquifer. Once such materials have entered the alluvium, it is reasonable to expect their subsequent discharge into the Potomac River with baseflow.

SECTION 4

FINDINGS

This section summarizes the hazardous wastes generated by installation activities, identifies hazardous waste accumulation and disposal sites located on the installation, and evaluates the potential environmental contamination from hazardous waste sites. Past waste generation and disposal methods were reviewed to assess hazardous waste management practices at Bolling AFB.

INSTALLATION HAZARDOUS WASTE ACTIVITY REVIEW

A review was made of past and present installation activities that resulted in generation, accumulation and disposal of hazardous wastes. Information was obtained from files and records, interviews with past and present installation employees and site inspections.

The sources of hazardous waste at Bolling AFB are grouped into the following categories:

- Industrial Operations (Shops)
- Waste Accumulation and Storage Areas
- Fuels Management
- Spills and Leaks
- Pesticide Utilization
- Fire Protection Training

The subsequent discussion addresses only those wastes generated at Bolling AFB which are either hazardous or potentially hazardous. Potentiallv hazardous wastes are grouped with and referenced as "hazardous wastes" throughout this report. A hazardous waste, for this report, is defined by, but not limited to, The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Compounds such as polychlorinated biphenyls (PCB) which are listed in the Toxic Substances Control Act (TSCA) are also considered hazardous. For study purposes, waste petroleum products such as contaminated fuels, waste oils and waste nonchlorinated solvents are also included in the "hazardous waste" category.

No distinction is made in this report between "hazardous substances/materials" and "hazardous wastes". A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the material.

Industrial Operations (Shops)

Summaries of industrial operations at Bolling AFB were developed from installation files and interviews. Information obtained was used to determine which operations handle hazardous materials and which ones generate hazardous wastes. Summary information on all installation shops is provided as Appendix E, Master List of Shops.

Industrial operations at Bolling AFB were grouped into the following nine main units:

- 1100 Air Base Wing
- AF Office of Special Investigations
- Defense Intelligence Agency
- 1100 Civil Engineering Squadron
- Malcolm Grow Medical Center
- 89th Military Airlift Wing
- 1700 Transportation Squadron Annex
- 1361 Audiovisual Squadron
- Car Care Center

Bolling shop files are maintained by Bioenvironmental Engineering Services (BES) located at Andrews AFB. BES provided a listing of industrial shops as well as individual shop files indicating past waste generation and hazardous material disposal practices.

For the shops identified as generating hazardous wastes, file data was reviewed and personnel were interviewed to determine the types and quantities of materials and present and past disposal methods. Information developed from base files and interviews with installation employees is summarized in Table 4.1.

TABLE 4.1
INDUSTRIAL OPERATIONS (Shops)
Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 1950 1960 1970 1980
1100 AIR BASE WING				
REPRODUCTION		ELECTROSTATIC SOLUTION	12 GALS./YR.	1938 DILUTED TO SANITARY SEWER
AUTO HOBBY	P8	TRANSMISSION FLUID	250 GALS./YR.	1953 FPTA/ANDREWS CE; 1975 OFF BASE CONTRACTOR
		PD 680	2,500 GALS./YR.	SANITARY SEWER; OFF BASE CONTRACTOR/SANITARY SEWER
		COOLING SYSTEM FLUSH	12 GALS./YR.	DILUTED TO SANITARY SEWER
		POWER STEERING FLUID	9 GALS./YR.	ANDREWS CE/ DILUTED TO SANITARY SEWER; 1975 OFF BASE CONTRACTOR
MARINA	928	WASTE OIL	110 GALS./YR.	1956 ENCLOSED IN CANS/LANDFILL; DPDO
CERAMICS	4472	PAINT	5 GALS./YR.	DUMPSTER
PHOTO HOBBY	4472	DEVELOPER	50 GALS./YR.	DILUTED TO SANITARY SEWER
		FIXER	36 GALS./YR.	DILUTED TO SANITARY SEWER
		PHOTO CHEMICALS	72 GALS./YR.	DILUTED TO SANITARY SEWER

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

FPTA FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)
INDUSTRIAL OPERATIONS (Shops)
Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1940, 1950, 1960, 1970, 1980)
AF OFFICE OF SPECIAL INVESTIGATIONS				
PHOTO SHOP	626	DEVELOPER	155 GALS./YR.	1980 DILUTED TO SANITARY SEWER
		FIXER	120 GALS./YR.	SILVER RECOVERY/DILUTED TO SANITARY SEWER
		PHOTO CHEMICALS	225 GALS./YR.	DILUTED TO SANITARY SEWER
GRAPHICS	626	DEVELOPER	90 GALS./YR.	DILUTED TO SANITARY SEWER
1100 CIVIL ENGINEERING SQUADRON				
HEATING MAINTENANCE	HANGER 1	MOTOR OIL	10 GALS./YR.	1939 FPTA 1950 FPTA/ANDREWS CE 1975 DPDO
ROADS AND GROUNDS	518	WASTE OILS	220 GALS./YR.	FPTA FPTA/ANDREWS CE DPDO
ENTOMOLOGY	38	EMPTY CANS/CONTAINERS	25 CONTAINERS/YR.	1937 RINSED AND SENT TO LANDFILL
		EQUIPMENT WASH	100 GALS./YR.	DILUTED TO SANITARY SEWER
HOUSING MAINTENANCE	902	LACQUERS, PAINTS AND ENAMELS	240 GALS./YR.	1957 CAPPED/DUMPSTER
		THINNERS	24 GALS./YR.	CAPPED/DUMPSTER
PAINT SHOP	HANGER 1	ACRYLIC PAINTS	48 GALS./YR.	1938 CAPPED/DUMPSTER
		LATEX PAINTS	120 GALS./YR.	DILUTED TO SANITARY SEWER
		THINNER	36 GALS./YR.	DILUTED TO SANITARY SEWER OR CAPPED/DUMPSTER 1984 DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

FPTA FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 - 1950 - 1960 - 1970 - 1980
MALCOLM GROW MEDICAL CENTER-ANNEX				
DENTAL LAB	1300	ACID	1 GAL./YR.	1941 DILUTED TO SANITARY SEWER (estimated) → 1984 NEUTRALIZED/DILUTED TO SANITARY SEWER
MEDICAL X RAY	1300	DEVELOPER	60 GALS./YR.	1950 DILUTED TO SANITARY SEWER
		FIXER	60 GALS./YR.	DILUTED TO SANITARY SEWER → SILVER RECOVERY/DILUTED TO SANITARY SEWER
89TH MILITARY AIRLIFT WING				
PMEL	P17	MERCURY	120 LBS./YR.	RECLAIMED AND REUSED (estimated, then confirmed) → 1983 DPDO
1700 TRANSPORTATION SQUADRON-ANNEX				
VEHICLE MAINTENANCE	362	WASTE OIL	6,000 GALS./YR.	1947 FPTA/REMOVAL THROUGH ANDREWS CE (estimated) → 1975 OFF-BASE CONTRACTOR → 1978
		SULFURIC ACID	30 GALS./YR.	DILUTED TO SANITARY SEWER
		THINNER	10 GALS./YR.	DILUTED TO SANITARY SEWER/REMOVAL THROUGH ANDREWS CE (estimated) → 1975 DPDO
		ANTIFREEZE	260 GALS./YR.	DILUTED TO SANITARY SEWER

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1940 – 1950 – 1960 – 1970 – 1980)
1361 AUDIOVISUAL SQUADRON				
PHOTO AND GRAPHICS LAB	P4	DEVELOPER	60 GALS./YR.	DILUTED TO SANITARY SEWER
		FIXER	36 GALS./YR.	SILVER RECOVERY/DILUTED TO SANITARY SEWER
		PHOTO CHEMICALS	60 GALS./YR.	DILUTED TO SANITARY SEWER 1980
CAR CARE CENTER				
GARAGE	41	WASTE OIL	12,000 GALS./YR.	FPTA; FPTA/REMOVAL THROUGH ANDREWS CE; OFF BASE CONTRACTOR
		SOLVENT	720 GALS./YR.	DILUTED TO SANITARY SEWER; REMOVAL THROUGH ANDREWS CE; OFF BASE CONTRACTOR
		TRANSMISSION FLUID	1,200 GALS./YR.	FPTA; FPTA/REMOVAL THROUGH ANDREWS CE; OFF BASE CONTRACTOR 1972
		COOLANT	1,800 GALS./YR.	DILUTED TO SANITARY SEWER

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

FPTA FIRE PROTECTION TRAINING AREA

Bolling AFB shops have undergone considerable change in their structure and function. When the base was first established numerous industrial shop facilities were constructed to serve the needs of aircraft maintenance and defense support. These shop facilities were very active through World War II and on into the 1950's. In 1958, a presidential study group completed a study of air space utilization in the Washington area and recommended removal of fixed-wing flight operations from Bolling AFB. By 1962, fixed-wing flight operations from the base had been transferred to Andrews AFB and the primary mission of Bolling changed to an administrative one. Thus, there are two main divisions for shop activities, 1937 to 1962, and 1962 to present.

Early Shop History (Circa 1937-1962)

Extensive industrial shop operations were located at Bolling AFB during this time period. Two hangers, constructed in 1939, housed many of these facilities. A third hanger was built in 1942 and a final, fourth hanger was constructed in 1943. Hangar 4, located near the marina, housed many of the Civil Engineering shops. Plating operations were apparently performed in Hangar 3.

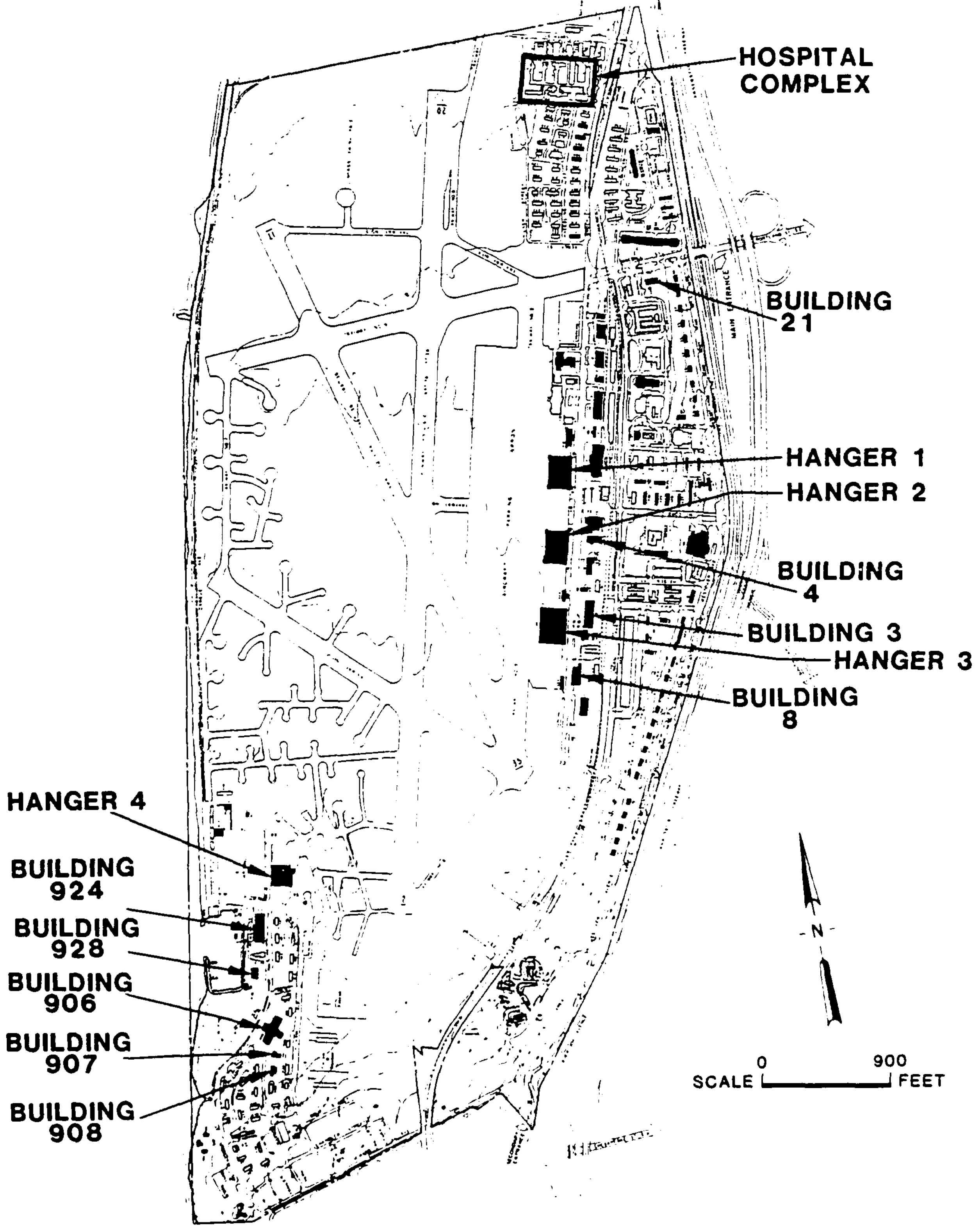
In addition to these facilities, real property records indicate other shop facilities located on base in this time period. Each shop is listed below along with the building number. Figure 4.1 is an early base map showing the location of these buildings:

Motor Pool and Garage	Building 3
Photo Laboratory	Building 4
Hobby Shop	Building 8
Dental Clinic	Building 21
Hospital	100 Complex
Sheet Metal Shop	Building 906
Paint Shop	Building 907
Carpenter Shop	Building 908
Motor Repair Shop	Buildings 924 and 928

Specific information on quantities of waste generated and waste disposal practices was not available for this early time period. A small fire protection training area was operated during these years and much of the

BOLLING AFB

SITE MAP CIRCA 1960



SOURCE: BOLLING AFB INSTALLATION DOCUMENTS

flammable shop waste was apparently used in training excercises. Wastes not readily ignitable were apparently dumped to sanitary and storm sewers. Materials such as ethylene glycol and non-flammable solvents were put directly into the storm sewer system. Small quantities of waste may have been placed directly into the river. Shop wastes were sometimes placed into covered cans and disposed into the dumpster. Circa 1950, Andrews AFB began collecting wastes stored in underground tanks, bowsers, or drums at Bolling and taking them to Andrews AFB for ultimate disposal.

Recent Shop History (1963-1985)

With the changeover to a nonflying mission, many of the industrial shops at Bolling AFB were phased out. Many of the buildings housing these shops, including Hangar 4, were torn down and replaced by family housing units. Hangars 2 and 3 were converted for base service uses. Hangar 1 was used for housing civil engineering.

The waste generated in the shops at Bolling, during this more recent period, has consisted primarily of waste oils and automotive fluids, solvents, paint strippers, acidic cleaning solutions, waste paints and spent reproduction fluids. Because many of these shops also existed during the early base years, the timelines in Table 4.1 span the late 1930's to 1985.

Waste acid and alkaline solutions have generally been disposed by neutralization with subsequent dilution to the storm or sanitary sewer system. Prior to the late 1970's, most of these wastes were discharged directly into the sewer system via drains or sinks. The dental lab experienced pipeline problems and has since switched to neutralization prior to disposal of acids. The Vehicle Maintenance Shop, located at the main base site until 1978, disposed of acid waste by dilution to the sanitary sewer. In 1978 this shop moved to the Anacostia Naval Air Station.

There are a number of reproduction, photographic, and graphic shops at the base. These shops have generated developer, fixer, and various other chemical waste. This material has been disposed directly to the base sewer system. Since approximately 1970, fixer has undergone silver reclamation and subsequent discharge to the sanitary sewer system.

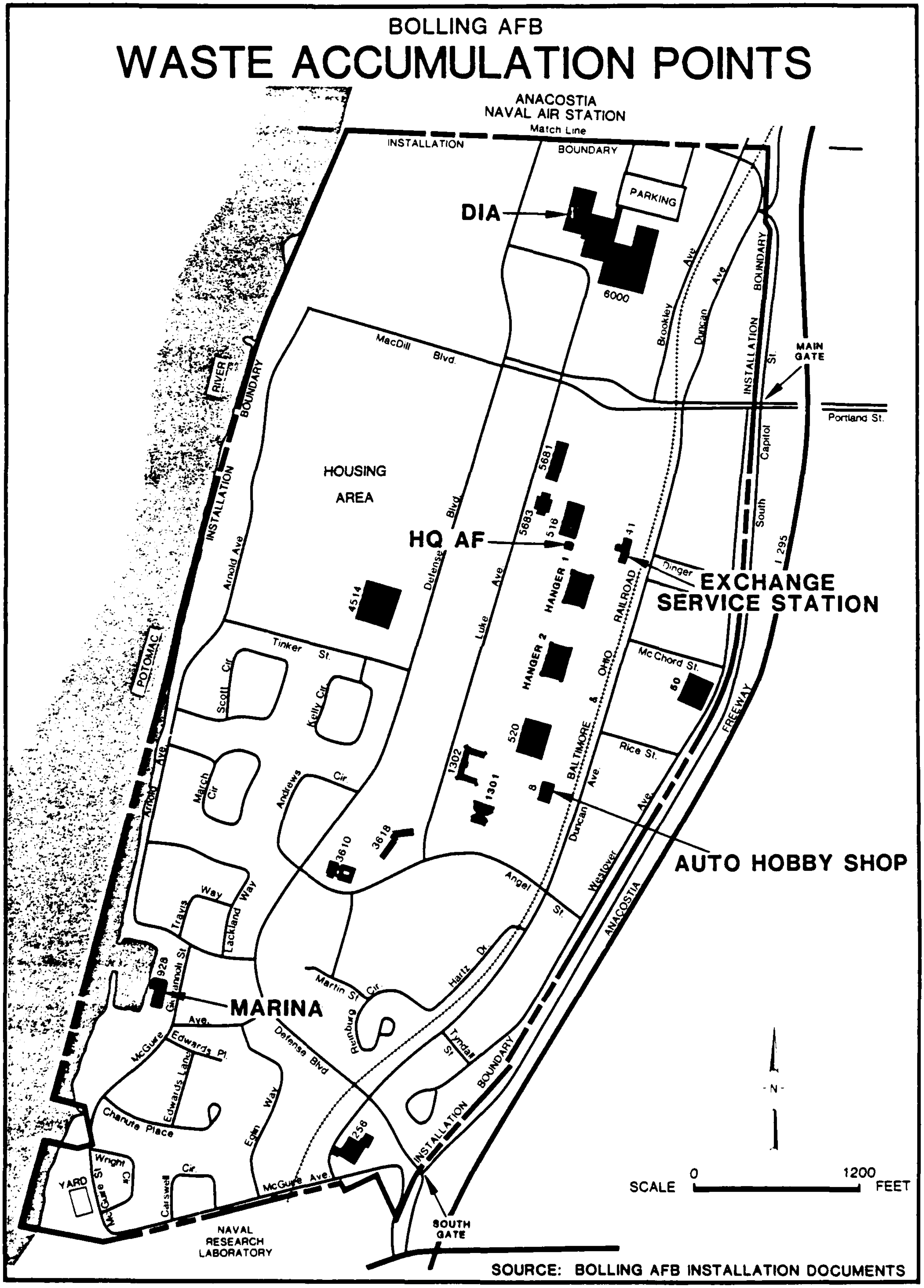
Liquid solvents and paint strippers, generated in several of the shops, were typically disposed in several ways. Prior to 1970 many of these wastes went directly to the sewer system. Once the DPDO was established at Brandywine, these wastes were collected in underground tanks and bowsers and periodically picked up for disposal through Brandywine DPDO. Small quantities of these wastes were enclosed in cans, and then placed in dumpsters for disposal. Currently, these wastes are collected in drums at designated Waste Accumulation Points (WAPs). Once drums are full, disposal is arranged through the Brandywine DPDO. Additionally, some small quantities of this waste are sent to the sewer system.

Waste oils and automotive fluids have been generated from the various civil engineering shops and vehicle maintenance shops on base. Much of this waste was placed in storage tanks and periodically picked up by Andrews Civil Engineering. Some waste was discharged directly to the sewer system. Oil water separators have been used to catch this waste and have been periodically cleaned by off-base contractors hired through Civil Engineering. Currently these wastes are collected at WAPs and subsequently handled by off-base contractors through Brandywine DPDO.

Paint waste has been generated in small quantities at various locations on the base. Much of this waste has been residual and has been disposed by capping with subsequent disposal to the dumpster. Latex paint waste has typically been disposed directly to the sanitary sewer. Significant quantities of paint waste are currently handled by collection at WAPs and subsequent disposal through Brandywine DPDO.

Waste Accumulation and Storage Areas

Wastes and hazardous materials are stored at designated areas on Bolling AFB. Certain shop wastes are brought to one of several designated waste accumulation points listed in Appendix D, Table D.1. Figure 4.2 shows the general location of the WAPs. The WAPs are utilized to accumulate and temporarily hold hazardous waste until disposal through the Brandywine DPDO may be arranged or until arrangements can be made for disposal by an off-base contractor. WAP's are physically located inside shop areas or in secured areas outside a shop or group of shops.



ES ENGINEERING-SCIENCE

Most of these facilities exhibited little or no visual contamination of the surface material (asphalt, gravel, or concrete). None of the WAPs exhibited the potential for future contamination.

Waste accumulation points at Bolling AFB are either underground storage tanks, or one or more storage drums. Shop waste has been brought to these areas for ultimate disposal. In some cases, shops have not utilized these areas to the full extent. Some shops have, in the past, practiced alternative disposal methods (see Table 4.1) because of the distance to these areas or because of inadequate knowledge regarding their function.

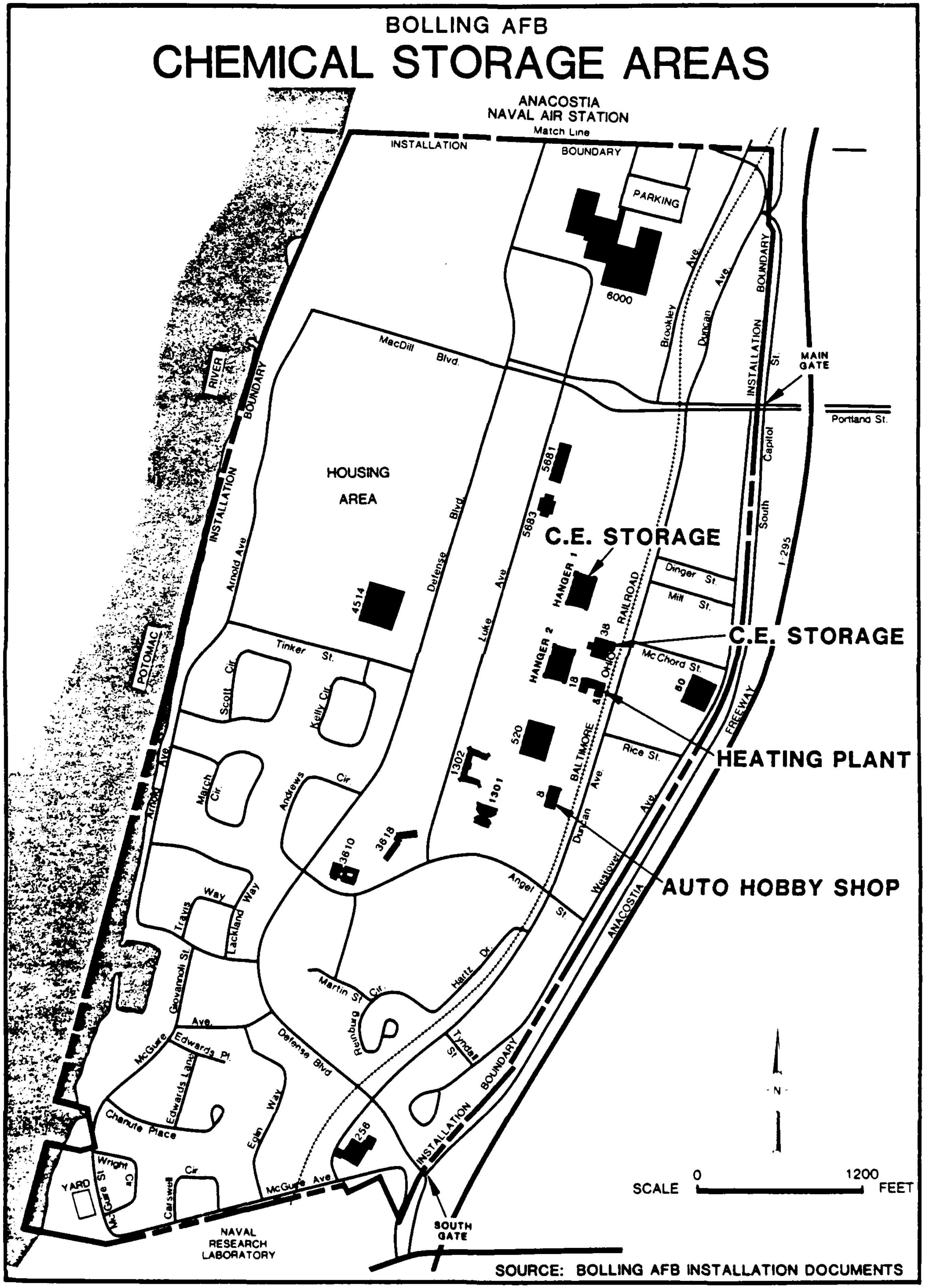
When waste containers are full, a transfer document is completed (in the case of drums) and the containerized waste is turned over to Brandywine DPDO for disposal. Because of the nature of the shops located at Bolling AFB and the type of waste generated, there is only a small amount of drummed waste disposed. Underground storage tanks are periodically pumped out by an off-base firm contracted through the Brandywine DPDO.

There are several chemical storage sites located on Bolling AFB. The auto hobby shop and heating plant maintain storage areas. Additionally, Civil Engineering maintains two areas for pesticide storage. Appendix D, Table D.2, lists all of these facilities along with their location and storage capacity. Figure 4.3 shows the location of the major storage areas.

Fuels Management

Prior to 1962, Bolling AFB fuels management system included AVGAS, jet fuel, motor vehicle fuel (MOGAS), diesel fuel and heating oil. Since 1962 Bolling AFB has had no flying mission, therefore no aircraft fuels were handled on base. Interviews with base personnel indicated that it was standard practice to remove all underground storage tanks when abandoned. This was necessary because of the small base area and high degree of development. The only known exceptions to this were a 150,000 gallon underground concrete tank adjacent to the heating plant (Building 18) and a 12,000 gallon underground tank at the Car Care Center, which were both left in place. There are no other known abandoned underground tanks on base.

FIGURE 4.3



ES ENGINEERING-SCIENCE

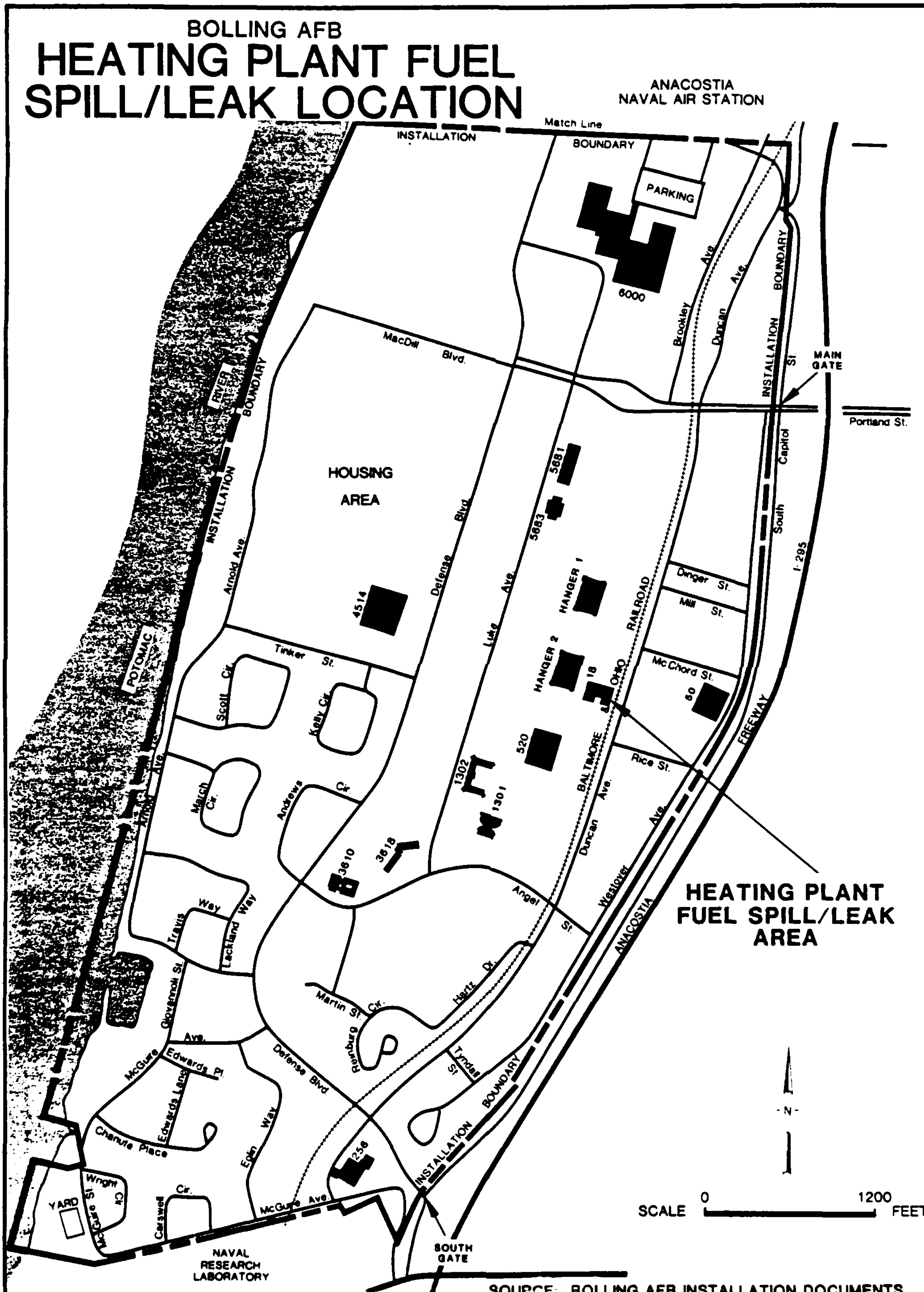
Table D.3, Appendix D, contains a listing of all tankage used to store petroleum or petroleum products on base.

Spills and Leaks

During the 1937-1962 time period, Bolling AFB operated numerous aircraft and had many industrial shop facilities to serve their needs. Spills of fuel and oil occurring during this time frame were not documented during the IRP visit because base records dating back to this time period were not available.

Since 1962, when the base mission changed to an adminstrative one, the likelihood of large spills or leaks occurring on base has significantly decreased. Numerous small spills/leaks of fuel and oil have been confirmed by base records and interviews with base personnel. These spills occurred onto paved areas or inside shop areas and were contained with absorbent materials or washed into the drainage system to an oil-water separator. As a result, no potential for environmental contamination is associated with these small spills.

The heating plant located in Building 18 (see Figure 4.4) has five underground oil storage tanks. Three of the tanks (each 25,000 gallons) are used as reserves. They are steel and were installed in 1954. The remaining two tanks are constructed in a concrete vault with a pipe gallery dividing the tanks. These tanks are each 75,000 gallons and were installed in 1972. There is an electric utility vault approximately 25 feet from these storage tanks which accumulates quantities of oil and water. Various oil spills have occurred in the past in the vicinity of the tanks. A large spill occurred when a pipe was left uncapped after a tank from this area was removed. Another large spill occurred when lines from the reserve tanks burst. The dates and quantities of these spills could not be determined. Residual oil from previous spills has been accumulating in the utility vault. In August of 1984 civil engineering noted that approximately 9 feet of an oil/water mixture was found in the pipe gallery. This area was pumped dry and some 5,000 gallons of water and oil were removed. There was indication that the source of this oil was from leaks in various lines. The water is presumed to be due to ground-water infiltration. Visual inspection of the site during the on-site visit confirmed the continued



SOURCE: BOLLING AFB INSTALLATION DOCUMENTS

presence of oil and water in the vault. Previous fuel spills or leaks in this area were evident and the potential for environmental contamination at this site exists.

Pesticide Utilization

Pest management has been performed at Bolling AFB as far back as the early 1940's. The location of the entomology shop has changed several times. When the base was first established, pest control was handled out of several different buildings. Building 520 was used for several years as the official entomology shop. In approximately 1969 the shop was moved to Hangar 1. A new building was constructed (Building 38) in 1984 so that the shop would meet all current regulations. The shop currently contains a diked pesticide storage and mix area with no drains so that accidental spills may be contained. Pesticides have also been stored in Building 4683.

Pest management has apparently been tightly controlled at Bolling AFB. Chemicals have been mixed as needed and there has typically been little residual leftover. When the shop was first established, it is likely that residual pesticide was diluted to the sanitary sewer. Pesticide containers have typically been triple rinsed, punctured and sent to dumpsters for disposal at an off-base landfill. These procedures have been followed since at least 1962.

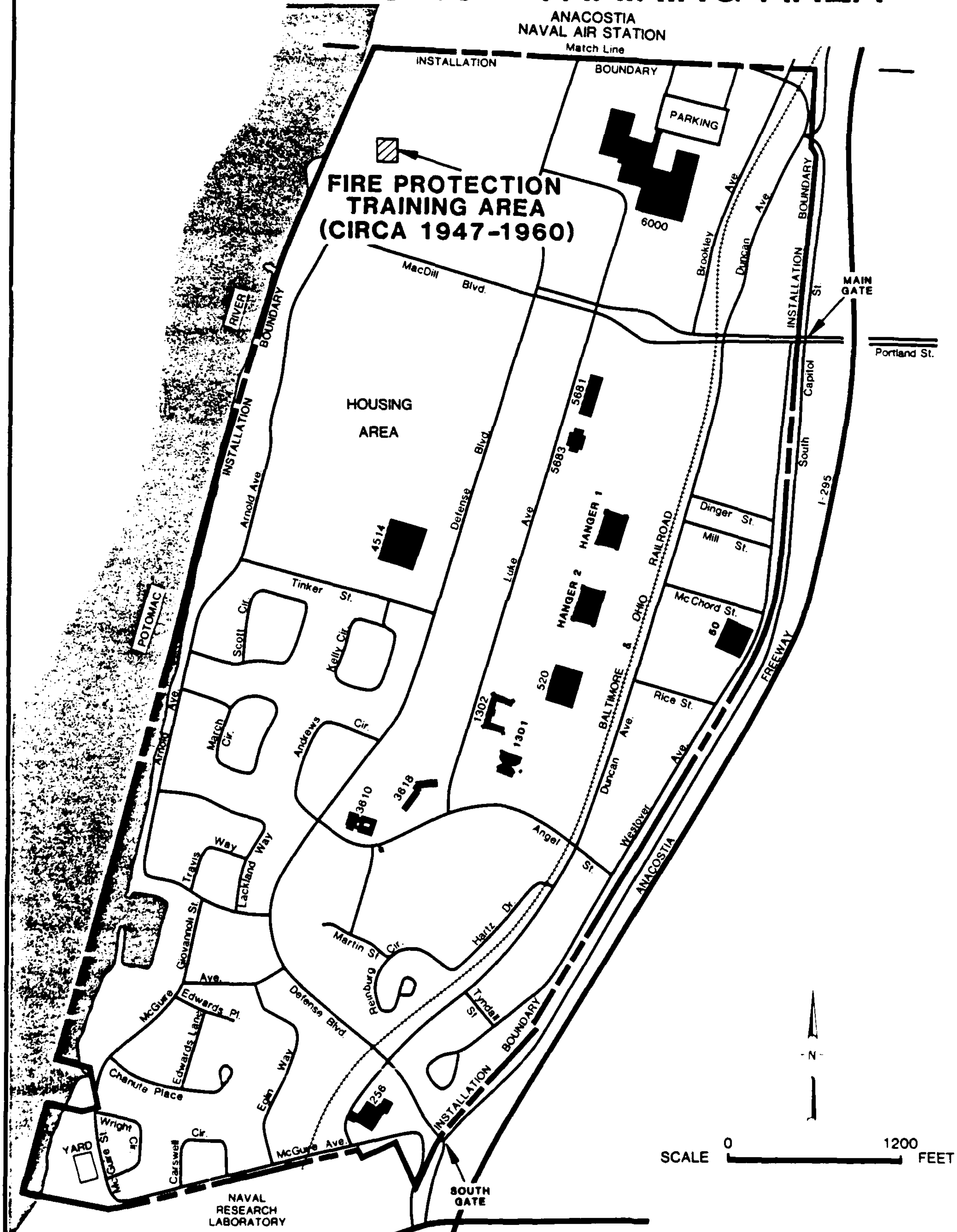
Appendix D, Table D.4 lists pest control agents currently in use or stored at the base. In addition, several pesticides no longer in use, including lindane, have been stored at the base. These pesticides were currently in the process of being turned over to Brandywine DPDO when the base visit was conducted.

Fire Protection Training

Prior to 1960, the Fire Department operated one fire protection training site at Bolling AFB. This site is shown in Figure 4.5. Drums of flammable liquids would be accumulated at the site. These drums would be drained onto the ground and burned during training exercises. Aerial photos did not indicate a well defined site. Visual examination of the site indicated no obvious remnants of contaminaton on-site, nor evidence of surficial contamination. However, due to the permeable soils at the site, a potential for contaminant migration exists since some of the fuel and waste residues may have seeped into the ground.

BOLLING AFB

FIRE PROTECTION TRAINING AREA



SOURCE: BOLLING AFB INSTALLATION DOCUMENTS

Since the 1960's, the Air Force has utilized the U.S. Navy Fire Department for Bolling AFB. Fire training for this group has been conducted at the Anacostia Naval Air Station for several years and is currently being done at the Washington, DC Fire Academy.

INSTALLATION WASTE DISPOSAL METHODS

The facilities at Bolling AFB, which have been used for the management and disposal of waste, can be categorized as follows:

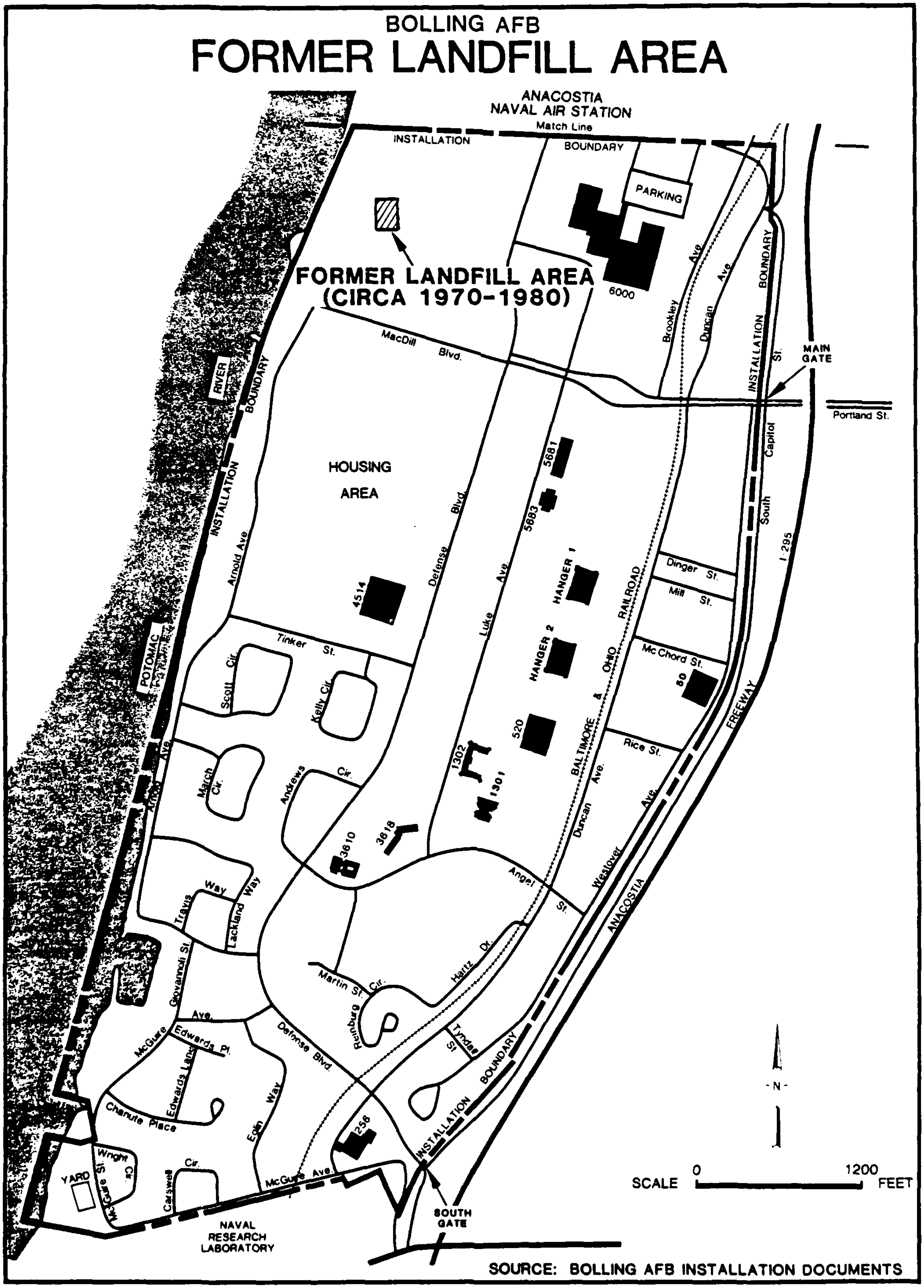
- Landfills/Hardfills
- Sanitary Sewer System
- Surface Drainage Systems
- Oil/Water Separators

Landfills/Hardfills

There has been only one site at Bolling AFB known to have been used as a landfill area. The location of this site is shown on Figure 4.6. The exact date this landfill was established is unknown. It is believed that dumping started in the mid to late seventies and continued until 1980. This site was used primarily for disposal of hardfill but was also used for various other items such as old paint and paint cans, small quantities of drummed shop waste, and old household appliances and furniture. The landfill was not operated as an official base landfill and there was little reference to it found in the base files. Several persons interviewed reported dumping small quantities of containerized shop waste in the landfill.

This area is currently covered with soil and vegetative growth and shows no sign of the previous landfill activities. Base personnel interviewed reported that dumping to this area ceased when the DIAC building was constructed. The site has a potential for environmental contamination and further IRP action is warranted.

There have been no other known landfill sites located at Bolling AFB. An area on the southern end of the base, along the river, has been used to store gravel, salt, and equipment used by the civil engineering group. Hardfill is also placed in this area and later removed off base.


BOLLING AFB
FORMER LANDFILL AREA
ANACOSTIA
NAVAL AIR STATION
Match Line
INSTALLATION
BOUNDARY
PARKING
FORMER LANDFILL AREA
(CIRCA 1970-1980)
6000
MacDill Blvd.
RIVER
POTOMAC
BOUNDARY
INSTALLATION
HOUSING
AREA
Defense Blvd.
Luke Ave.
Brookley Ave.
Duncan Ave.
INSTALLATION
BOUNDARY
MAIN
GATE
Portland St.
South Capitol St.
I-295
5681
5683
HANGER 1
HANGER 2
4514
Arnold Ave.
Dinger St.
Mill St.
McChord St.
50
RAILROAD
BALTIMORE & OHIO
Tinker St.
Scott Cir.
Kelly Cir.
520
1302
1301
Rice St.
March Cir.
Andrews Cir.
Arnold Ave.
3610
3618
Duncan Ave.
Westover Ave.
Angel St.
ANACOSTIA
FREEWAY
Travis Way
Lackland Way
Giovannoli St.
Martin St.
Hartz Dr.
Reinburg Cir.
McGuire Ave.
Edwards Pl.
Edwards Lane
Defense Blvd.
Tyndall St.
BOUNDARY
INSTALLATION
Chanute Place
Eglin Way
256
Wright Cir.
YARD
McGuire St.
Carswell Cir.
McGuire Ave.
NAVAL
RESEARCH
LABORATORY
SOUTH
GATE
- N -
SCALE 0 1200 FEET
SOURCE: BOLLING AFB INSTALLATION DOCUMENTS

Base dumpsters, including dumpsters containing household waste, were hauled off-base by Air Force personnel to the city landfill until 1959. At that time a commercial hauler began removing this waste.

Sanitary Sewerage System

The current sanitary sewer system at Bolling AFB has been in use since the 1940's. Sewers are connected at several locations into the District of Columbia trunk sewer line which crosses the base in a north-south direction. Sewage is either gravity fed or pumped into the trunk line which flows to the Blue Plains sewage treatment plant. Since this system was installed, it has been used by several shops as a means of waste disposal. Wastes such as ethylene glycol and photographic solutions were commonly discharged directly to the sewer system. Shops which generated small amounts of waste often discharged all waste to the sewer system. Currently small quantities of various wastes (i.e., photographic solutions, latex paints, cleaning compounds) are discharged to the sewer but are diluted with copious amounts of water in the process.

There has been no sanitary sewage treatment facilities located at Bolling AFB.

Surface Drainage Systems

The storm drainage system on Bolling AFB consists of a system of gutters, inlets, catch basins and subsurface piping. Although the system is fairly extensive, much of it is currently clogged with debris.

All normal drainage is designed to flow by gravity to the discharge point, the Potomac River. The construction of extensive residential housing has increased run-off levels to the river. The system has experienced severe backup problems during heavy rainfall events due to its current state. This system is scheduled for cleaning and upgrade in the near future.

Oil-Water Separators

There are several areas on base currently served by oil-water separators. Separators are used in areas which have relatively high quantities of waste liquids that may contain oils and grease. These devices are serviced periodically by an off-base contractor through base

Civil Engineering. Water from separators is discharged to the sewer system. Locations of oil-water separators are given in Appendix D, Table D.5.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

Review of past waste generation and management practices at Bolling AFB has resulted in identification of three sites and/or activities which were considered as areas of concern for potential contamination and migration of contaminants.

Sites Eliminated from Further Evaluation

The sites of initial concern were evaluated using the Flow Chart presented in Figure 1.2. Sites not considered to have a potential for contamination would be deleted from further evaluation at this stage. All three sites of environmental concern at Bolling AFB were determined to need further IRP evaluation and thus all sites were rated using the HARM system. Table 4.2 summarizes the results of the flow chart logic for each of the areas of initial concern.

Sites Evaluated Using HARM

The three sites identified in Table 4.2 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. Results of the HARM analysis for the sites are summarized in Table 4.3.

The procedures used in the HARM system are outlined in Appendix G and the specific rating forms for the three sites at Bolling AFB are presented in Appendix H. The HARM system is designed to indicate the relative need for follow-on action.

TABLE 4.2
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN
AT BOLLING AFB

Site	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Fire Protection Training Area	Yes	Yes	Yes
Landfill No. 1	Yes	Yes	Yes
Heat Plant Oil Leak	Yes	Yes	Yes

Source: Engineering-Science

TABLE 4.3
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SITES
AT BOLLING AFB

Rank	Site	Receptor Subscore	Waste Charac-teristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
1	Heat Plant Oil Leak	53	64	80	1	66
2	Fire Protection Training Area	48	60	54	1	54
3	Landfill No. 1	48	60	54	1	54

NOTE: HARM Score = [(Receptors + Waste Characteristics + Pathways) x 1/3] x Waste Management Factor

Source: Engineering-Science

SECTION 5

CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on field inspections; review of records and files; review of the environmental setting; interviews with base personnel, past employees and local, state and federal government employees; and assessments using the HARM system. Table 5.1 contains a list of the potential contamination sources identified at Bolling AFB and a summary of the HARM scores for those sites.

HEATING PLANT OIL LEAK

The Heating Plant (Building 18) has burned No. 4 fuel oil since 1954. The plant has five underground fuel oil storage tanks totaling 225,000 gallons. Three of the tanks are steel and were installed in 1954. Two other tanks are concrete and installed in 1972. An electric utility vault 25 feet from the tanks has received accumulations of oil and water in the past. Various oil spills have occurred in the vicinity of the tanks. Water accumulating in the utility vault would appear to be ground water and not surface runoff since the vault manhole is raised. This site holds a potential for environmental contamination and further action is recommended.

Ground water in this area is shallow, varying from 5 to 15 feet below the surface. Soil consists of highly variable fill over alluvium varying from sand to organic silt and clay. This site received a HARM rating of 66.

TABLE 5.1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
BOLLING AFB

Rank	Site	Operation Period	HARM Score (1)
1	Heating Plant Oil Leak	-	66
2	Fire Protection Training Area	1947-1962	54
3	Landfill No. 1	1970-1980	54

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

FIRE PROTECTION TRAINING AREA

The fire protection training area (FPTA) operated at Bolling AFB from approximately 1940 to 1962. Waste fuels and other flammable materials generated from the industrial shop operations were brought to this area and used in fire training exercises. Quantities of materials and exact procedures used could not be accurately determined. This site holds a potential for environmental contamination and further action is recommended.

Groundwater in this area is shallow, varying from 5 to 15 feet below the surface. Soil consists of highly variable fill over alluvium varying from sand to organic silt and clay with local accumulations of peat. This site received a HARM rating of 54.

LANDFILL NO. 1

Landfill No. 1, located at the northern end of the base and adjacent to the former FPTA, was used circa 1970-1980. The site was utilized primarily for disposal of hardfill material but small quantities of hazardous wastes were also reportedly discarded in the fill. Most of this waste was containerized in small cans or in some cases, drums. Because of the location of this site and the unknown nature of materials disposed, this site is recommended for further IRP action.

Soils in the area consist of highly variable fill over alluvium, varying from sand to organic silt and clay with local accumulations of peat. This site received a HARM rating of 54.

SECTION 6

RECOMMENDATIONS

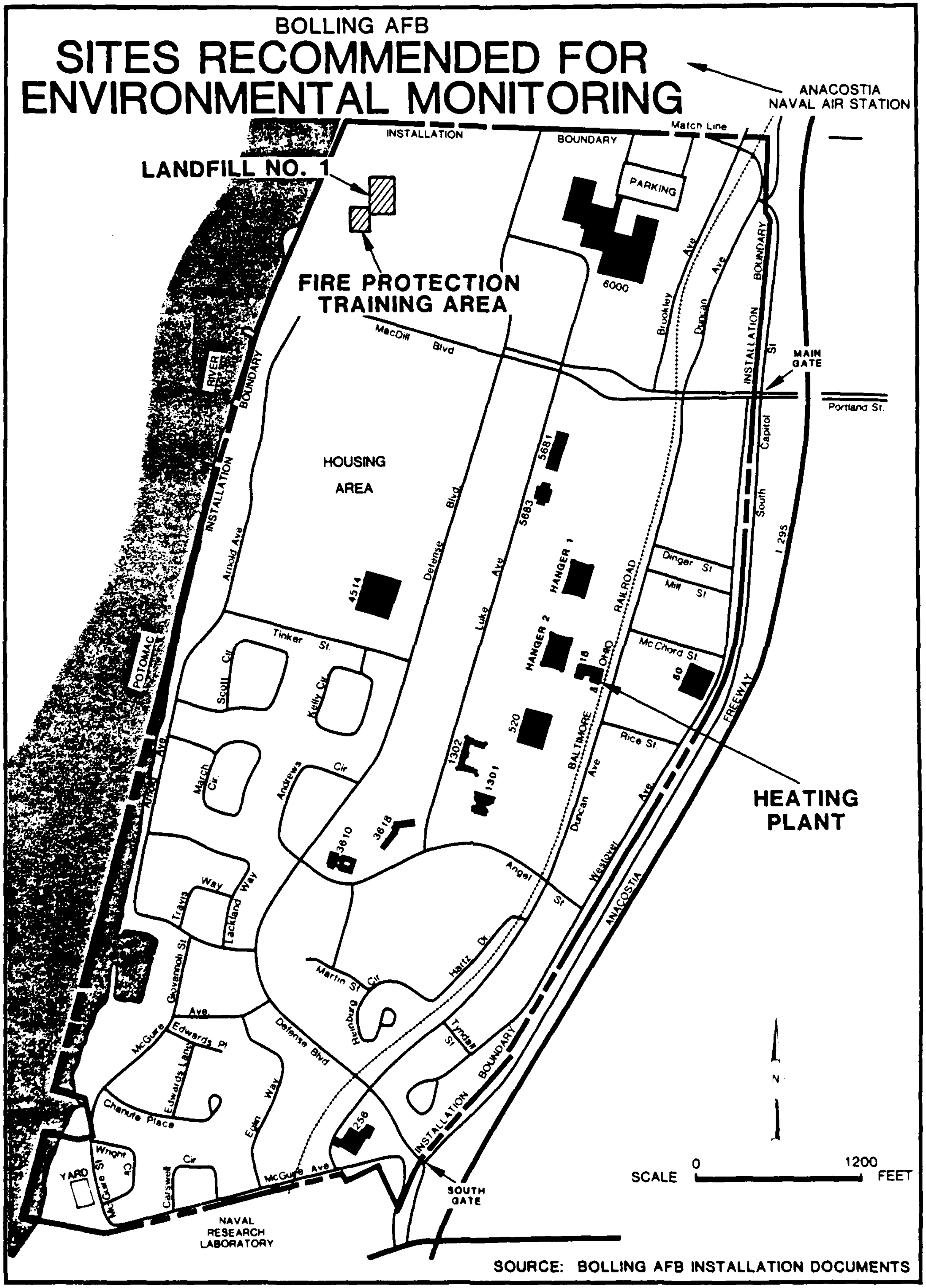
Three sites were identified at Bolling AFB as having the potential for environmental contamination. These sites have been evaluated and rated using the HARM system which assesses their relative potential for contamination and provides the basis for determining the need for additional Phase II IRP investigations. All of the sites have sufficient potential to create environmental contamination and warrant Phase II investigations. Figure 6.1 shows the location of the sites recommended for environmental monitoring. The sites evaluated have been reviewed concerning land use restrictions, which may be applicable.

PHASE II MONITORING RECOMMENDATIONS

The following recommendations are made to further assess the potential for environmental contamination from waste disposal areas at Bolling AFB. The recommended actions are generally one-time sampling programs to determine if contamination does exist at the site. If contamination is identified, the sampling program may need to be expanded to further define the extent and type of contamination.

The hydrogeologic conditions present at each waste disposal facility are entirely site-specific due to variations in geology, topography, land use modifications, etc. These natural conditions or man-made changes in the local environmental setting must be clearly understood in order to design an effective ground-water quality monitoring system. At present, the site-specific conditions existing at the Bolling AFB sites are unknown. Soil test borings and temporary observation wells may be employed to obtain site-specific information. A systematic, more efficient and cost-effective approach would be to utilize geophysical techniques to obtain local subsurface information. Electrical resistivity (ER) and electromagnetic conductivity (EMC) are geophysical

FIGURE 6.1


BOLLING AFB
SITES RECOMMENDED FOR ENVIRONMENTAL MONITORING
ANACOSTIA NAVAL AIR STATION
Match Line
INSTALLATION BOUNDARY
LANDFILL NO. 1
FIRE PROTECTION TRAINING AREA
PARKING
6000
MAIN GATE
Portland St.
HOUSING AREA
HEATING PLANT
POTOMAC RIVER
SOUTH GATE
NAVAL RESEARCH LABORATORY
YARD
N
SCALE 0 1200 FEET
SOURCE: BOLLING AFB INSTALLATION DOCUMENTS

instruments that employ indirect measurement technologies to collect data describing subsurface material electrical properties. They respond to changes or contrasts in either the horizontal or vertical planes which may be correlated to direct sampling methods, such as test borings. Both methods may be utilized in shallow situations (less than thirty feet deep) if local geology permits, to determine stratigraphic changes, depth to ground water, aquifer thickness and contaminated zones if sufficient contrast in the local geology exists. ER may be employed in more complicated terrains or in situations where deep contamination is suspected. Wells may then be installed systematically, in zones selected by the geophysical technique. This approach to monitoring program design significantly reduces both costs and schedules.

The use of geophysical techniques at waste disposal facilities has been well documented in the technical literature. A USEPA guidance manual describes the capabilities and limitations of electrical resistivity at waste disposal facilities and is applicable to the probable conditions that may be encountered at Bolling AFB (USEPA, 1978). Other geophysical methodologies can be utilized for specialized purposes - for example, a metal detector may be used in shallow settings to locate buried ferrous materials and the magnetometer may be utilized to locate either buried objects or disturbed zones (backfilled trenches or pits) in shallow and deep settings.

Ground-water quality monitoring systems must be designed for the site-specific conditions existing at a waste disposal facility. Guidelines for well system design have been published in several USEPA reports. One report indicates that a few guidelines are applicable to conditions such as those noted at Bolling AFB. For large areas/landfills, or for areas with multiple ground-water flow directions, it is recommended that more than the usual four wells (one upgradient and three downgradient, from RCRA, Subpart F, Section 265.91, "Ground-water Monitoring System") may be required. Where multiple flow directions may exist beneath a site, geophysical methods should be utilized to guide well placement, both the physical location and the screened interval. In situations where the site is physically large or has an unusual geometry and therefore has a long downgradient dimension (the site border, which when sketched on a topographic map, appears to be drawn at a right angle to the principle direction of ground-water flow), the general rule is to install one monitoring well for each 250 feet of downgradient frontage (USEPA, 1980, page 41). This well spacing is considered to be a maximum allowable interval between wells, assuming that local hydrogeologic conditions are reasonably uniform. Wells must be installed at closer intervals if the site subsurface conditions are determined to be complex.

Following the geophysical surveys, the proper placement of soil borings and/or ground-water monitoring wells can be determined. Those sites with a potential for ground-water contamination will be monitored with 4-inch diameter wells consisting of Schedule 40 PVC screens and casing with threaded joints. Screens will be placed opposite the full saturated thickness of the uppermost aquifer. If the initial ground-water samples indicate contamination, additional wells may be required. The number of wells may be reduced if the geophysical techniques are successful in identifying discrete leachate plumes. The recommended monitoring program for Phase II is summarized in Table 6.1.

Heating Plant Oil Leak

The area adjacent to the underground fuel oil storage tanks has the potential for environmental contamination and monitoring of the site is required. Because of the large amount of interferences below grade, it is felt that geophysical techniques would not be applicable. One upgradient and three downgradient water quality monitoring wells should be installed within the uppermost aquifer of the site. Samples taken from these wells should be analyzed for the parameters listed in Table 6.2, List A.

Fire Protection Training Area

The former fire protection training area has the potential for environmental contamination and monitoring of the site is recommended. Prior to any soil sampling or monitoring well installation activities, a geophysical study should be conducted. An electromagnetic conductivity survey may be sufficient to determine subsurface conditions at shallow depths. Other geophysical techniques should be employed, as needed, to more adequately define the site-specific hydrogeology. The survey, if effective, should be used to guide the placement of a soil boring in the

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR
PHASE II
BOLLING AFB

Site Name	Rating Score	Recommended Monitoring	Sample Analyses List(1)	Comments
Heating Plant Oil Leak	66	Install and sample 1 upgradient and 3 downgradient wells.	A	If sampling indicates contamination, continue monitoring. Additional wells may be necessary to assess extent of contamination.
Fire Protection Training Area (2)	54	Conduct geophysical survey (electromagnetic conductivity); place one soil boring in approximate center of burn area; install and sample one upgradient and three downgradient wells.	B	If sampling indicates contamination, continue monitoring. Additional wells and soil borings may be necessary to assess extent of contamination.
Landfill No. 1 (2)	54	Conduct geophysical survey (electromagnetic conductivity); install and sample one upgradient and three downgradient wells.	A	If sampling indicates contamination, continue monitoring. Additional wells may be necessary to assess extent of contamination.

(1) See Table 6.2
(2) Phase II confirmation studies may be combined for these sites.

TABLE 6.2
RECOMMENDED LIST OF
ANALYTICAL PARAMETERS
BOLLING AFB

List A	EPA Method Number
pH	150.1
Total Dissolved Solids	160.2
Oil and Grease	413.1
Total Organic Carbons	415.1
Total Organic Halogens	9020
Phenols	420.1
Chromium (VI)	218.4
Lead	239.1
List B	
Oil and Grease	413.1
Volatile Organics	624
Total Organic Halogens (Water Samples Only)	9020
Total Organic Carbon (Water Samples Only)	415.1
EP Toxicity (Soil Samples Only)	1310
List C	
pH	150.1
Oil and Grease	413.1
Volatile Organics	624
Total Organic Halogens (Water Samples Only)	9020
Total Organic Carbon (Water Samples Only)	415.1
Phenols	420.1
Total Dissolved Solids (Water Samples Only)	160.2
Chromium (VI)	218.4
Lead	239.1
EP Toxicity (Soil Samples Only)	1310

approximate center of the former burn area, and/or where the geophysical data suggests gross soil contamination. Sampling should be performed at two-foot intervals, beginning at ground surface and should be terminated at the water table. Selected soil samples from these borings should be analyzed for the parameters listed in Table 6.2, List B. Using the geophysical survey as a guide, one upgradient and three downgradient wells should be installed within the uppermost aquifer of the site. Ground-water samples from the wells should be analyzed for the parameters listed in Table 6.2, List B.

Landfill No. 1

Landfill No. 1 holds the potential for environmental contamination and monitoring of the site is recommended. Because of the proximity of the landfill to the former fire protection training area, the FPTA geophysical study area may be expanded to include the landfill area. No soil borings should be taken in this area. The geophysical surveys should be used to aid in the placement of a ground-water quality monitoring system. One upgradient and three downgradient wells should be installed within the uppermost aquifer of the site. Samples taken from these wells should be analyzed for the parameters listed in Table 6.2, List A.

Depending on the findings from the geophysical surveys, one monitoring system for both the former FPTA site and Landfill No. 1 may be appropriate. In this case, the samples should be analyzed for the parameters listed in Table 6.2, List C.

RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

It is desirable to have land use restrictions for the identified sites: (1) to provide continued protection of human health, welfare, and environment; (2) to insure that migration of potential contaminants is not promoted through improper land uses; (3) to facilitate compatible development of future USAF facilities; and (4) to allow for identification of property which may be proposed for excess or outlease.

The recommended guidelines for land use restrictions at each identified disposal site at Bolling AFB are presented in Table 6.3. A description of the land use restriction guidelines is included in Table 6.4. Land use restrictions at sites recommended for on-site monitoring

TABLE 6.3
RECOMMENDED GUIDELINES FOR FUTURE LAND USE RESTRICTIONS
BOLLING AFB

Site Name	Construction	Excavation	Wells	Agriculture	Silviculture	Water Infiltration	Recreation	Burning	Disposal Operations	Vehicular Traffic	Material Storage	Housing
Heating Plant Oil Leak	R	R	R	R	R	R	R	R	R	NR	NR	R
Fire Protection Training Area	R	R	R	R	R	R	NR	R	R	R	NR	R
Landfill No. 1	R	R	R	R	R	R	NR	R	R	R	NR	R

Notes: NR = No Restriction
R = Restriction

TABLE 6.4
DESCRIPTION OF GUIDELINES FOR LAND USE RESTRICTIONS

Guideline	Description
Construction on the site	Restrict the construction of structures which make permanent (or semi-permanent) and exclusive use of a portion of the site's surface.
Excavation	Restrict the disturbance of the cover or subsurface materials.
Well construction on or near the site	Restrict the placement of any wells (except for monitoring purposes) on or within a reasonably safe distance of the site. This distance will vary from site to site, based on prevailing soil conditions and ground-water flow.
Agricultural use	Restrict the use of the site for agricultural purposes to prevent food chain contamination.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials).
Water infiltration	Restrict water run-on, ponding and/or irrigation of the site. Water infiltration could produce contaminated leachate.
Recreational use	Restrict the use of the site for recreational purposes.
Burning or ignition sources	Restrict any and all unnecessary sources of ignition, due to the possible presence of flammable compounds.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Vehicular traffic	Restrict the passage of unnecessary vehicular traffic on the site due to the presence of explosive material(s) and/or of an unstable surface.
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.

should be re-evaluated upon completion of the Phase II program and appropriate changes made.

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APPENDICES

APPENDIX A

BIOGRAPHICAL DATA

APPENDIX A

BIOGRAPHICAL DATA

Biographical Data

Charles M. Mangan

Senior Environmental Engineer

Personal Information

Date of Birth: 23 August 1944

Education

B.S. in Civil Engineering, 1966, Newark College of Engineering
M.S. in Civil Engineering, 1967, New York University

Professional Affiliations

Registered Professional Engineer (Tennessee No. 11607, Georgia No. 012577, New Jersey No. 18366, New York No. 48280)
Diplomate - American Academy of Environmental Engineers
Water Pollution Control Federation
American Society of Civil Engineers
American Water Works Association

Honorary Affiliations

Chi Epsilon

Experience Record

1967-1970 Quirk Lawler and Matusky Engineers, New York, New York Project Engineer. Responsible for a $400,000 water system renovation in Walton, New York. This included water main cleaning, a test well program and water main installation. In addition, supervised a surveying team and boring crew used for a stand pipe site evaluation.

As a staff engineer in the design department, participated in the design of an industrial wastewater treatment plant for Carleton Woolen Mills in Maine. Participated in various equipment evaluations prior to the writing of the required specifications.

1970-1980 Roy F. Weston Inc. West Chester, PA and Atlanta, GA Assistant Project Engineer. Supervised current and diffusion studies off the coast of Aquadilla, Puerto Rico, and subsequently prepared a conceptual design report for a primary wastewater treatment plant and ocean outfall design.

Charles M. Mangan (Continued)

Prepared a reference manual on various wastewater treatment processes which are applicable to the upgrading of existing treatment plants. The manual was used by EPA in their Technology Transfer program at Seminars being held for consulting engineers throughout the United States.

While working in conjunction with the Luzerne County Planning Board, prepared a solid waste regional plan to be implemented under the requirements of Pennsylvania Act 241.

Prepared an operations manual for Washington Suburban Sanitary Commission's (WSSC) 5 MGD advanced wastewater treatment plant at Piscataway, Maryland. Unit operations include 2 stage line precipitation of phosphorus, recarbonation for pH adjustment, dual media filtration and carbon adsorption for suspended and dissolved organics removal.

1980-Date Engineering-Science, Inc. Atlanta, Georgia. Manager of Environmental Studies. Recent experience included the water permitting for a petroleum refinery expansion for Hess Oil Co. in southern Mississippi, and developmental permits including Corps Section 404 and 10, and coastal zone permits for 20,000 acres of coastal property in eastern North Carolina. Other pertinent experience includes a site assessment for a pulp and paper mill in southern Alabama and an environmental assessment for a major wastewater treatment plant expansion.

Performed a solid waste management evaluation for New Hanover County, North Carolina. Conducted hazardous waste audits on three U.S. Air Force bases to identify past chemical handling practices and the possibility of contaminant migraton off the base property.

Project Manager for eight Phase I Installation Restoration program projects for the U.S. Air Force. The objective of this program is to audit past hazardous waste disposal practices that could result in migration of contaminants and recommend priority sites requiring further investigation.

Biographical Data

SUSAN K. MINICUCCI

Chemical/Environmental Engineer

Personal Information

Date of Birth: 30 September 1957

Education

B.S.E. Chemical Engineering, Michigan State University, E. Lansing, Michigan, 1980

M.S.E. Environmental Engineering, University of Michigan, Ann Arbor, Michigan, 1984

Professional Affiliations/Honors

Water Pollution Control Federation
American Institute of Chemical Engineers
American Society of Civil Engineers
Society of Women Engineers
U.S.P.H.S. Scholarship
Public Health Service Achievement Medal
Public Health Service Unit Commendation Medal

Experience Record

1978 — National Institute for Occupational Safety and Health. Rockville, Maryland. Research work to provide background toxicological information from which recommended standards for occupational exposure may be derived. Responsibilities included assessment of health hazards, environmental fate, and toxic and hazardous properties of various chemicals.

1979 — E. I. du Pont de Nemours. Troy, Michigan. Designed and implemented a laboratory research project to improve process time for in-plant procedures.

1980-1983 — U.S. Public Health Service, Food & Drug Administration, Office of Radiological Health, Rockville, Maryland. Regulatory Engineer. Evaluation of quality control programs used in the manufacture of diagnostic x-ray equipment, conducted facility inspections to evaluate test programs to assure compliance with federal regulations, procurement and analysis of computer data pertaining to equipment failure and system design, development of a computerized/compliance status monitoring system which incorporated risk analyses for health and safety for radiological equipment. Involved in assessing risk to populations exposed to various types of ionizing radiation devices. Member of the task force for promulgation of new regulations for computed tomography x-ray systems for publication in the Federal Register. Completed several courses in Basic Radiological Health and Safety.

1983-1984 University of Michigan - Research Assistant. Research involving parameter evaluation for predictive modeling and design of multicomponent adsorption systems.

1984-Present Engineering-Science, Atlanta, Georgia. Project Engineer responsible for various activities within the hazardous waste group. Lead responsibility in preparation of remedial investigation and feasibility study reports for several consenting defendents under a Partial Consent Decree. Included a detailed analysis of remedial action programs. Hazardous waste group activities include landfill evaluations, waste disposal alternative evaluations, permit and regulatory assistance, transportation evaluation, and waste management program development. Design of mobil onsite wastewater treatment facilities.

Biographical Data

JOHN R. ABSALON
Hydrogeologist

Personal Information

Date of Birth: 12 May 1946

Education

B.S. in Geology, 1973, Upsala College, East Orange, New Jersey

Professional Affiliations

Certified Professional Geologist (Indiana No. 46) (Virginia No. 241)
Association of Engineering Geologists
Geological Society of America
National Water Well Association

Experience Record

1973-1974 Soil Testing Incorporated-Drilling Contractors, Seymour, Connecticut. Geologist. Responsible for the planning and supervision of subsurface investigations supporting geotechnical, ground-water contamination, and mineral exploitation studies in the New England area. Also managed the office staff, drillers, and the maintenance shop.

1974-1975 William F. Loftus and Associates, Englewood Cliffs, New Jersey. Engineering Geologist. Responsible for planning and management of geotechnical investigations in the northeastern U.S. and Illinois. Other duties included formal report preparation.

1975-1978 U.S. Army Environmental Hygiene Agency, Fort McPherson, Georgia. Geologist. Responsible for performance of solid waste disposal facility siting studies, non-complying waste disposal site assessments, and ground-water monitoring programs at military installations in the southeastern U.S., Texas, and Oklahoma. Also responsible for operation and management of the soil mechanics laboratory.

1978-1980 Law Engineering Testing Company, Atlanta, Georgia. Engineering Geologist/Hydrogeologist. Responsible for the project supervision of waste management, water quality assessment, geotechnical, and hydrogeologic studies at commercial, industrial, and government facilities. General experience included planning and management of several ground-water monitoring programs, John R. Absalon (Continued)

development of remedial action programs, and formulation of waste disposal facility liner system design recommendations. Performed detailed ground-water quality investigations at an Air Force installation in Georgia, a paper mill in southwestern Georgia, and industrial facilities in Tennessee.

1980-Date Engineering-Science. Hydrogeologist. Responsible for supervising efforts in waste management, solid waste disposal, ground-water contamination assessment, leachate generation, and geotechnical and hydrogeologic investigations for clients in the industrial and governmental sectors. Performed geologic investigations at twelve Air Force bases and otherindustrial sites to evaluate the potential for migration of hazardous materials from past waste disposal practices. Conducted RCRA ground-water monitoring studies for industrial clients and evaluated remedial action alternatives for a county landfill in Florida. Conducted quality management, hydrogeologic and ground-water quality programs for the pulp and paper industry at several mills located in the Southeast United States.

Publications and Presentations

Eleven presentations and/or papers in technical publications or conferences dealing with geology, ground water, and waste disposal/-ground water interaction.

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

TABLE B.1
LIST OF INTERVIEWEES

	Position	Years of Service at This Installation
1.	NCOIC, Vehicle Maintenance Shop	2
2.	NCOIC, Photo Shop, AFOSI	2
3.	NCOIC, Heavy Equipment Shop	3
4.	Foreman, Pest Control	19
5.	Retired Chief of Planning, CE	25
6.	Supervisor of Reproduction	24
7.	NCOIC, Reproduction	1
8.	Marina Operator	6
9.	NCOIC, Ceramics Shop	3
10.	NCOIC, Photo Hobby	5
11.	NCOIC, Graphics, AFOSI	3
12.	NCOIC, Heating Maintenance	8
13.	Mechanic, Roads and Grounds	5
14.	Structural Foreman, Family Housing Maintenance	5
15.	NCOIC, Pavements	5
16.	Foreman, Paint Shop	10
17.	NCOIC, Exterior Electric	9
18.	NCOIC, Dental Lab	1
19.	NCOIC, Medical X-ray	1
20.	NCOIC, PMEL	2
21.	NCOIC, Vehicle Maintenance	5
22.	NCOIC, Photo and Graphics	2

TABLE B.1
LIST OF INTERVIEWEES
(Continued)

	Position	Years of Service at This Installation
23.	Base Environmental Coordinator	3
24.	Assistant, Real Property Office	4
25.	Real Property Officer	1
26.	Bioenvironmental Engineer	3
27.	Chief, Service Contracts	30
28.	Former Environmental Coordinator	1
29.	Chief, Housing Maintenance	27
30.	Material Supply Officer	22
31.	Chief, Car Care Center	3
32.	Chief, Refrigeration	8
33.	Secretary, Wing Commander	28
34.	Chief, Fire Department	20
35.	NCOIC, Motor Pool	2
36.	Fireman, Fire Department	38
37.	Supervisor, Roads and Grounds	5
38.	Deputy Base Civil Engineer	2
39.	Vehicle Control Officer	38
40.	Contracts Administration	17
41.	Foreman, Roads and Grounds	13
42.	Assistant Fire Chief	12
43.	Retired Deputy Base Civil Engineer	12

TABLE B.1
LIST OF INTERVIEWEES
(Continued)

Position	Years of Service at This Installation
44. DIAC, Environmental Engineer	1
45. Maintenance Supervisor	3
46. Base Historian	1

TABLE B.2
OUTSIDE AGENCY CONTACTS

Agency	Point of Contact
US Geological Survey Water Resources Division 208 Carroll Building 8600 LaSalle Road Towson, MD 21204 301/828-1535	Frank Chapelle, Hydrogeologist
RCRA Enforcement Section Environmental Protection Agency, Region III 841 Chestnut Street Philadelphia, PA 19106 215/597-8392	Vickie Province, Compliance Officer
Federal Facilities Program US Environmental Protection Agency, Region III 841 Chestnut Street Philadelphia, PA 19106 215/597-1168	Steve Hirsch, Environmental Scientist
Water Quality Branch District of Columbia Department of Environmental Services 5010 Overlook Avenue, S.W. Washington, D.C. 20032 202/767-7370	M. Siddique, Environmental Engineer
Hazardous Waste Management Program District of Columbia Department of Environmental Services 5010 Overlook Avenue, S.W. Washington, D.C. 20032 202/767-8414	Byron Bacon, Sanitarian

TABLE B.2
OUTSIDE AGENCY CONTACTS
(Continued)

Agency	Point of Contact
Modern Military Field Branch Washington National Record Center 4025 Suitland Road Suitland, MD 301/763-1710	Mr. W. Lewis
Cartographic and Architectural Branch National Archives 841 S. Pickett Street Alexandria, VA 22304 703/756-6700	Mr. J. Dwyer
Modern Military Branch National Archives 8th and Pennsylvania Avenue Washington, DC 202/523-3340	Mr. E. Reese
Office of Air Force History Bolling AFB Washington, DC 202/767-5090	Sgt. Jernigan

APPENDIX C

TENANT MISSIONS - BOLLING AFB

APPENDIX C

TENANT MISSIONS - BOLLING AFB

DETACHMENT 1, 1500 COMPUTER SERVICES SQUADRON (MAC)

Provides base level automated data processing support to Bolling AFB.

DETACHMENT 4, 1361st AUDIOVISUAL SQUADRON (MAC)

Provides base level support to the 1100th Air Base Wing and other Bolling supported activities.

DETACHMENT 1, 2045th INFORMATION SYSTEMS GROUP

Operates and maintains all communication support equipment for Bolling AFB.

OFFICE OF AIR FORCE HISTORY (AF/CHO)

Prepares and publishes general and special histories, monographs, studies, bibliographies, and catalogs for the use of the Air Force and the public. Also formulates policy for, and directs the Air Force Historical Program as a whole.

DIRECTORATE OF ADMINISTRATION (AF/DA)

Provides career management guidance for the administrative officer resources, monitorship of manpower guidance, and guidance on commercial activities for potential contracting out, world-wide publishing and reprographics policy and world-wide policy on acquiring and operating administrative systems.

OFFICE OF THE CHIEF OF CHAPLAINS (AF/HC)

The Director of the Air Force Chaplain Service, serves as the Chaplain Staff Advisor to the Secretary of the Air Force and the Chief of Staff, USAF, on religion, ethical concerns and the quality of life of personnel, also serves as Chaplain to HQ USAF.

GENERAL PURPOSE THREAT DIVISION (AF/INEG)

Insures application of intelligence to Air Staff and MAJCOM analytical studies addressing USAF strategic and tactical weapon systems acquisition programs and force structure developments.

STRATEGIC STUDIES DIVISION (AF/INES)

Participates in the preparation of National and Joint Intelligence estimates on Soviet military doctrine and strategy and Soviet foreign and domestic policies under the aegis of the National Foreign Intelligence Board and the Defense Intelligence Agency.

USAF TRIAL JUDICIARY, FIRST CIRCUIT (AF/JAJTE-1)

Provides and manages military judges, circuit trial and defense counsels for general and special court-martial, UCMJ, Article 32 Investigations, administrative boards, and other legal proceedings as required by the Judge Advocate General.

DIRECTORATE OF ENGINEERING AND SERVICES (AF/LEE)

Responsible for the acquisition, management and disposal of USAF Real Property world-wide, except government owned contractor operated (GOCO) facilities. Also responsible for the preparation and maintenance of the AF Real Property Inventory, providing engineering and construction support, and providing environmental policy.

USAF OFFICE OF THE SURGEON GENERAL (AF/SG)

Maintains the health of AF personnel to ensure maximum wartime readiness and combat strength and provides (to the greatest extent possible) a peacetime health care system for all dependents.

WASHINGTON AREA ADP SUPPORT OFFICE (OL AK, AFMPC/MPCDW)

Provides ADP support in the way of computer programming, report production, system requirements analysis, technical assistance and AFMPC liaison in ADP related matters for the DCS/MP activities in the Washington, DC area.

AIR FORCE CIVILIAN APPELLATE AGENCY (AFCARA)

Develops, manages, operates, and evaluates the AF program for the consideration of formal individual discrimination complaints against the AF and for appeals and grievances submitted by appropriated fund employees under the AF Regulatory Appeal and Grievance System.

BOLLING AFB COMMISSARY (OL LD, AFCOMS/FCS)

Provides the widest possible food selection for active duty, reservist, and retirees families.

HEADQUARTERS AIR FORCE ELEMENT/TECHNICAL ASSISTANCE GROUP (AFETAG)

Provides personnel and administrative support to special developmental projects as directed by HQ USAF.

DIRECTORATE OF SOVIET AFFAIRS (AFIS/INC)

Conducts USAF Soviet Awareness programs designed to keep each AF member informed and aware of Soviet doctrine, strategy, tactics, force structure, and combat employment.

DIRECTORATE OF INTELLIGENCE DATA MANAGEMENT (AFIS/IND)

Provides leadership to the AF intelligence community by developing future plans that focus and conserve intelligence resources by applying automated data processing (ADP) systems to the tasks of intelligence.

DIRECTORATE OF TARGET INTELLIGENCE (AFIS/INOT)

OPR and executive agent for the Air Staff for target intelligence matters to include: weapons, target analysis, force application, mission planning, and target materials. Also the focal point for AF mapping, charting and geodesy matters to include: geophysics, AF point of contact with Defense Mapping Agency (DMA), and program element monitor for service support to DMA.

AIR FORCE OFFICE OF SPECIAL INVESTIGATIONS (AFOSI)

Provides criminal, fraud, counterintelligence, internal security and special investigative services for AF activities. Performs protective service operations. Collects, analyzes and disseminates information of investigative and counterintelligence significance. Operates the USAF Special Investigations Academy (USAFSIA). Responsible for the USAF Technical Surveillance Countermeasures (TSCM) Program.

DETACHMENT 411, AIR FORCE OFFICE OF SPECIAL INVESTIGATIONS

Provides special investigative services to the interested unit commanders assigned to Bolling AFB.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR)

Planning, managing, implementing, and controlling the USAF Defense Research Sciences Program funded by program element 61102F.

AIR RESERVIST MAGAZINE (TAR)

Provides members of the Air Reserve forces with authoritative, informative and readable news and information of the missions, policies and programs of the Air Force, Air National Guard and Air Force Reserve.

USAF-CIVIL AIR PATROL NATIONAL CAPITAL WING LIAISON OFFICE

Provides advice and assistance to the National Capital Wing, Civil Air Patrol, in the mission areas of search and rescue, aerospace education, and the cadet program. The USAF-CAP Liaison Office is the link between the AF and the CAP.

APPENDIX D

SUPPLEMENTAL BASE FINDINGS INFORMATION

TABLE D.1
WASTE ACCUMULATION POINTS

Location	Facility	Substance	Capacity	Storage
Building 8	Auto Hobby Shop	Waste Oil	550 Gal	Underground Tank
Building 41	Exchange Service Station	Waste Oil	2-500 Gal	Underground Tank
Building 928	Marina	Waste Oil	55 Gal	Drum
Building 516	HQ AF	Waste Paints & Thinners	55 Gal	Drum
Building 6000	DIAC	Waste Oil	1000 Gal	Underground Tank

Source: Installation Documents.

TABLE D.2
CHEMICAL STORAGE AREAS

Building	Facility	Substance	Capacity	Storage
8	Auto Hobby Shop	Solvent & Cleaning Compound	200 Gallons	Above ground 55-gallon drums
18	Heating Plant	Diewguard 4109 Methyl Ethyl Ketone	Variable	Above ground 55-gallon drums
38	C.E. Storage	Herbicides, Insecticides	Variable	Containers
6000	DIAC	Photochemicals	550 Gallons	Above ground 55-gallon drums
1	Roads and Grounds	Vapco Scale Cleaner	Variable	Above ground 55-gallon drums
928	Marina	Paint Thinner	Variable	Containers
902	Housing Maintenance	Paint Thinner	Variable	Containers
626	Reprographics	Multi-graphic	Variable	Containers
4472	Photo Hobby Shop	Developers	Variable	Containers

Source: Installation Documents.

TABLE D.3
PETROLEUM STORAGE TANKS
BOLLING AFB

Facility Number	Facility	Type of POL	Capacity (gallons)	Storage Description
18	Heating Plant	#4 Fuel Oil	25,000	3 ea Underground Tanks
		#4 Fuel Oil	75,000	2 ea Underground Tanks
		#2 Fuel Oil	275	1 ea Aboveground Tanks
		-	150,000	Abandoned, filled with sand
41	Car Care Center	-	12,000	Abandoned, filled with sand
902	MFH Maintenance Shop	#2 Fuel Oil	1,000	Aboveground Tank
928	Marina Bldg.	#2 Fuel Oil	275	Aboveground Tank
		Motor Gasoline	4,000	Underground Tank
		Mogas	2,000	Underground Tank
		Mogas	1,000	Underground Tank
2482	Slip Inn	#2 Fuel Oil	275	Aboveground Tank
2565	NCO Club	#2 Fuel Oil	1,000	Underground Tank
3610	Chapel	#2 Fuel Oil	2,500	Underground Tank
852	TLQ	#2 Fuel Oil	275	Aboveground Tank
6000	DIAC	#2 Fuel Oil	20,000	3 ea. Underground Tanks
		#2 Fuel Oil	2,500	Underground Tank
4578	Gas Station	MOGAS	10,000	4 ea. Underground Tanks

Source: Installation Documents

TABLE D.4
PESTICIDE INVENTORY AS OF SEPTEMBER, 1984
BOLLING AFB

Amino-Triazole
Bannel 4-S
Baygon
Methoxychlor
Paraquat Cl
Phaltan/Zineb
Bird Tanglefoot
Borocil IV
Bromacil
Chlordane
Diazinon
Dursban
Dormant Oil
Embark 2-5
Ficam
Kelthane 35
Malathion
Phostoxin
Round-Up
Pyrethrin
Sevin
d-Phenothrin (2%)
DDVP-dichlorvos
2,4-D
Bromodiolone - Supercaid
Lignasan BLP
Talon-G

Source: Installation Documents.

TABLE D.5
OIL-WATER SEPARATORS
BOLLING, AFB

Location	Building Number
Auto Hobby Shop	8
Exchange Service Station	41
DIAC	6000

Source: Installation Documents.

APPENDIX E

MASTER LIST OF INDUSTRIAL SHOPS

BOLLING AFB

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
BOLLING AFB

Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Waste Management Practices
1100 Air Base Wing (ABW)				
Reproduction	626	yes	yes	Diluted to sanitary sewer.
Auto Hobby	P8	yes	yes	Off-base contractor and sanitary sewer
Marina	928	yes	yes	DPDO
Ceramics	4472	yes	yes	Dumpster
Photo Hobby	4472	yes	yes	Diluted to sanitary sewer
Frame	4472	yes	no	---
Wood Hobby Shop	4472	yes	no	---
SPS	Various	no	no	---
AF Office of Special Investigations (AFOSI)				
Carpenter	626	yes	no	---
Metal	626	yes	no	---
Reproduction	626	yes	no	---
Photo	626	yes	yes	Diluted to sanitary sewer
Graphics	626	yes	yes	Diluted to sanitary sewer

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
BOLLING AFB
(Continued)

Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Waste Management Practices
Defense Intelligence Agency (DIA)				
Heating & Refrig.	6000	yes	yes	DPDO & sanitary sewer
1100 Civil Engineering Squadron (CES)				
Interior & Exterior Electric	Hanger 1	yes	no	---
Heating Maintenance	Hanger 1	yes	yes	DPDO
Air Conditioning/ Refrigeration	Hanger 1	yes	no	---
Key & Carpenter	Hanger 1	yes	no	---
Masonry	Hanger 1	yes	no	---
Heavy Equipment	518	yes	no	---
Pavements	518	yes	no	---
Roads & Grounds	518	yes	yes	DPDO
Heat Plant	18	yes	no	---
Entomology	38	yes	yes	Empty containers triple rinsed and punctured
Housing Maintenance	902	yes	yes	Dumpster
Plumbing	Hanger 1	yes	no	---
Paint Shop	Hanger 1	yes	yes	DPDO and sanitary sewer

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
BOLLING AFB
(Continued)

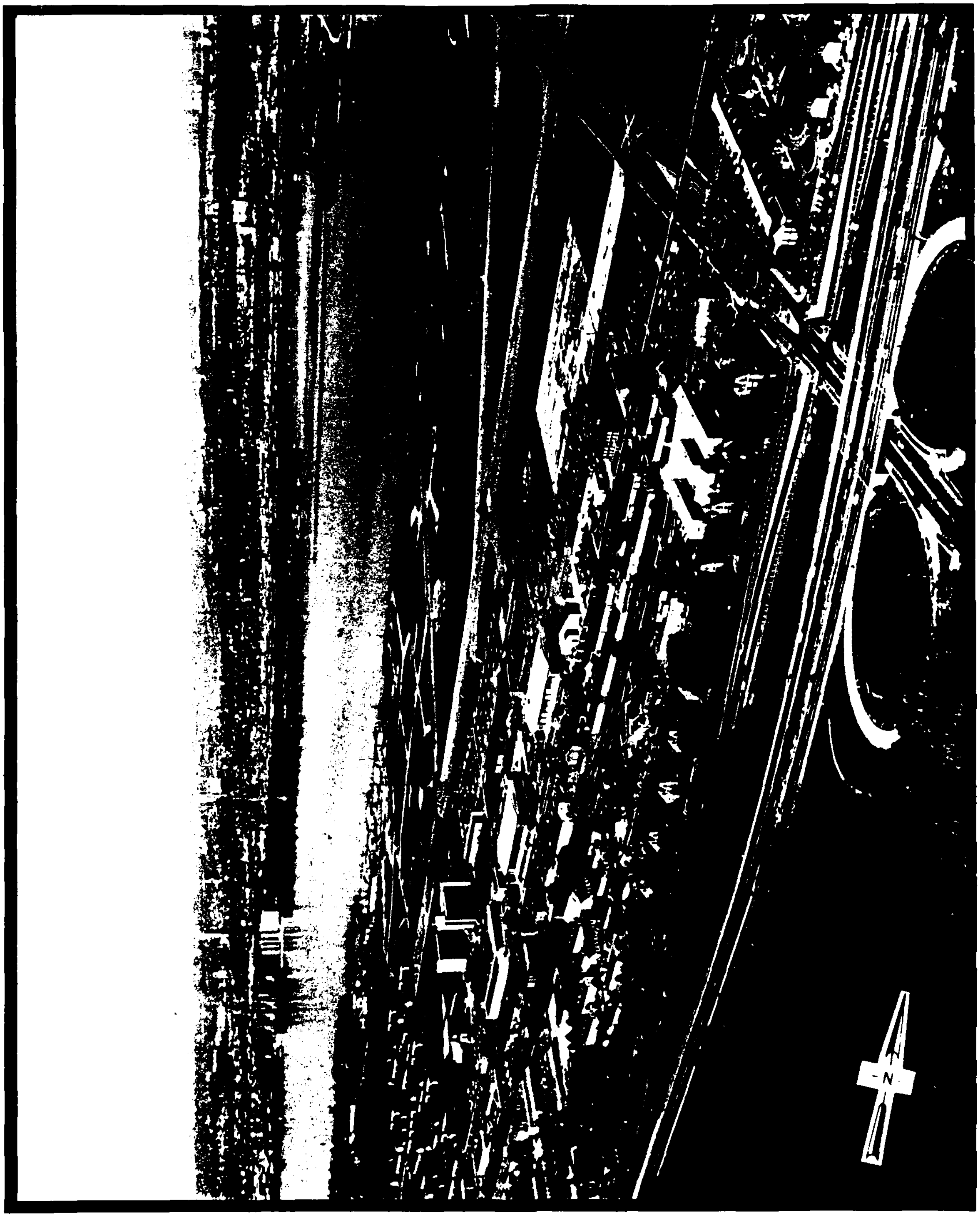
Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Waste Management Practices
1100 Civil Engineering Squadron (CES) (Continued)				
Sheet Metal	Hanger 1	yes	no	---
Welding	Hanger 1	yes	no	---
Malcolm Grow Medical Center (MGMC) Annex				
Dental Lab	1300	yes	yes	Neutralized & diluted to sanitary sewer
Dental Clinic	1300	yes	no	---
Laboratory	1300	yes	no	---
Medical X-Ray	1300	yes	yes	Diluted to sanitary sewer
89th Military Airlift Wing (MAW)				
PMEL	P17	yes	yes	DPDO

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
BOLLING AFB
(Continued)

Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Waste Management Practices
1361 Audiovisual Squadron (AVS)				
Photo and Graphics Lab	P4	yes	yes	Silver reclamation. Diluted to sanitary sewer.
Car Care Center				
Garage	41	yes	yes	Off-base contractor, diluted to sanitary sewer

APPENDIX F

PHOTOGRAPHS



BOLLING AFB, DISTRICT OF COLUMBIA CIRCA 1970

BOLLING AFB

Former Fire Protection Training Area

Landfill No. 1

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

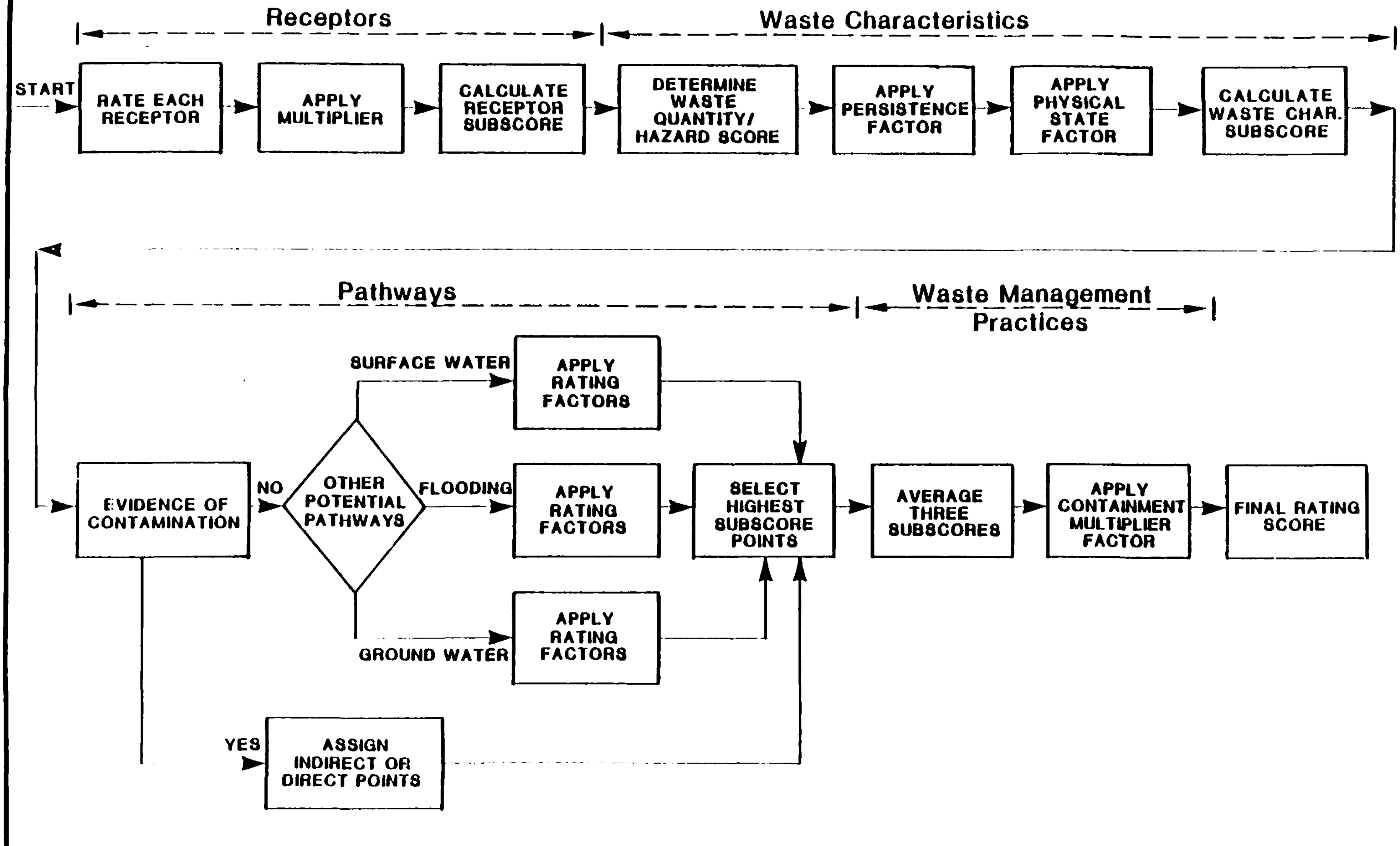


FIGURE 1

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______

LOCATION ______

DATE OF OPERATION OR OCCURRENCE ______

OWNER/OPERATOR ______

COMMENTS/DESCRIPTION ______

SITE RATED BY ______

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
Subtotals			______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
Subtotals			______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

SITE HAZARD ASSESSMENT RATING FORMS

APPENDIX H

TABLE OF CONTENTS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Heating Plant Oil Leak
Location: Building 18 Underground Storage Tanks
Date of Operation: August 1984
Owner/Operator: Bolling AFB
Comments/Description: Oil / water mixture in electric utility vault near underground tanks
Site Rated by: S.K.Minicucci; C.M.Mangan; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			95	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 53

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.00 = 64

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 80

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			42	108
Subscore (100 x factor score subtotal/maximum score subtotal)				39
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			44	114
Subscore (100 x factor score subtotal/maximum score subtotal)				39

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		53	
Waste Characteristics		64	
Pathways		80	
Total	197	divided by 3 =	66 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

66 x 1.00 = \ 66 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fire Protection Training Area
Location: West of DIA , along river edge
Date of Operation: 1947 to 1960
Owner/Operator: Bolling AFB
Comments/Description: Drums of flammable liquids stored at site and periodically used for fire training
Site Rated by: S.K.Minicucci; C.M.Mangan; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			87	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 48

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.00 = 60

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			58	108
Subscore (100 x factor score subtotal/maximum score subtotal)				54
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
Subtotals			52	114
Subscore (100 x factor score subtotal/maximum score subtotal)				46

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	48
Waste Characteristics	60
Pathways	54

Total 162 divided by 3 = 54 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

54 x 1.00 = \ 54 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Landfill No. 1
Location: West of DIA , North of softball field 3
Date of Operation: 1970's to 1980
Owner/Operator: Bolling AFB
Comments/Description: Primarily hardfill , some shop waste

Site Rated by: S.K.Minicucci; C.M.Mangan; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			87	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 48

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.00 = 60

III. PATHWAYS

A. If there is evidence of mi... ..ion of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			58	108
Subscore (100 x factor score subtotal/maximum score subtotal)				54
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	1	8	8	24
Subtotals			60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		48
Waste Characteristics		60
Pathways		54
Total	162	divided by 3 = 54 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

54 x 1.00 = 54

FINAL SCORE

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

ABG: Air Base Group.

ACFT MAINT: Aircraft Maintenance.

ADC: Air Defense Command.

AF: Air Force.

AFB: Air Force Base.

AFCS: Air Force Communications Service.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent.

AFOSI: Air Force Office of Special Investigation

AFR: Air Force Regulation.

AFRES: Air Force Reserve.

AFS: Air Force Station.

AFSC: Air Force Systems Command.

Ag: Chemical symbol for silver.

AGE: Aerospace Ground Equipment.

Al: Chemical symbol for aluminum.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

AMS: Avionics Maintenance Squadron

ANG: Air National Guard.

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

AROMATIC: Description of organic chemical compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than non-aromatics.

ARTESIAN: Ground water contained under hydrostatic pressure.

AQUICLUDE: Poorly permeable formation that impedes ground-water movement and does not yield to a well or spring.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes ground-water flow.

ATC: Air Training Command.

AVGAS: Aviation Gasoline.

AVS: Audiovisual Squadron

BEDROCK: Any solid rock exposed at the surface of the earth or overlain by unconsolidated material.

BEE: Bioenvironmental Engineer.

BES: Bioenvironmental Engineering Services.

BOWSER: A portable tank, usually under 200 gallons in capacity.

BX: Base Exchange.

CAP: Civilian Air Patrol.

Cd: Chemical symbol for cadmium.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CES: Civil Engineering Squadron.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

COASTAL PLAINS: Physiographic province of the Eastern United States characterized by a gently seaward sloping surface formed over exposed, unconsolidated, stratified marine fluvial sediments. Typical coastal plain features include low hills and ridges, organic deposits, floodplains and high water tables.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

COLLUVIUM: Sediments that have moved down slope primarily under the influence of gravity or as periodic, unchannelized flow. It frequently includes large boulders or other fragments which contrast this matrial to alluvium, material deposited by channelized flow which results in some degree of sorting according to particle size.

COMD: Command.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

CONUS: Continental United States.

CPG: Certified Professional Geologist

Cr: Chemical symbol for chromium.

Cu: Chemical symbol for copper.

D: Disposal Site.

DEQPPM: Defense Environmental Quality Program Policy Memorandum

DET: Detachment.

DIA: Defense Intelligence Agency

DIAC: Defense Intelligence Analysis Center

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground water.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DPDO: Defense Property Disposal Office, previously included Redistribution and Marketing (R&M) and Salvage.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

ELECTRICAL RESISTIVITY (ER): Specialized equipment designed to produce an electrical current through subsurface geologic strata. The instrument and the technique permit the operator to examine conditions at specific depths below land surface. Subsurface contrasts indicative of specific geologic or hydrologic conditions may be obtained through correlation of the ER data with known site information such as that provided by test borings or well construction logs.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL: Short-lived or temporary.

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science, Inc.

ESCARPMENT: A long, usually continuous cliff or relatively steep slope facing one general direction, breaking the continuity of the land by separating two level or gently sloping surfaces; produced by erosion or faulting.

FAA: Federal Aviation Administration.

FACILITY (As Applied to Hazardous Wastes): Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FPTA: Fire Protection Training Area.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown compounds.

GEOPHYSICS: (Geophysical survey) the use of one or more geophysical instruments or methods to measure specific properties of the earth's subsurface through indirect means. Geophysical equipment may include electrical resistivity, geiger counter, magnetometer, metal detector, electromagnetic conductivity, magnetic susceptibility, etc. Geophysics seeks to provide specific measurements of the earth's magnetic field, the electrical properties of specific geologic strata, radioactivity, etc., by use of indirect techniques.

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GLAUCONITIC SAND AND GRAVEL: A mixture of sand, gravel and glaucomite, an iron-potassium silicate mineral which imparts a green color to the mixture. Glauconite is geologically significant because it indicates slow sedimentation.

GLIDE-BLOCK: A large section of a geologic unit that has separated from the main portion of the unit due to earthquake/landslide-induced lateral movement.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of the Superfund bill.

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HQ: Headquarters.

HWAP: Hazardous Waste Accumulation Point.

HWMF: Hazardous Waste Management Facility.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the subsurface.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

JP-4: Jet Propulsion Fuel Number Four; contains both kerosene and gasoline fractions.

JP-5: Jet Propulsion Fuel Number Five; consists of high boiling kerosene fractions.

LANDFILL: A land disposal site used for disposing solid and semi-solid materials. May refer either to a sanitary landfill or dump.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LITHOLOGY: The description of the physical character of a geologic material.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color, primarily deposited by wind.

LYSIMETER: A vacuum operated sampling device used for extracting pore water samples at various depths within the unsaturated zone.

m: Milli (10^{-3}).

MAC: Military Airlift Command.

MAGNETOMETER (MG): A device capable of measuring localized variations in the earth's magnetic field that may be due to disturbed areas such as backfilled trenches, buried objects, etc. Measurements may be obtained at points located on a grid pattern so that the data can be contoured, revealing the location, size and intensity of the suspected anomaly.

MAINT: Recording System Maintenance.

MAW: Military Airlift Wing.

MEK: Methyl Ethyl Ketone.

METALS: See "Heavy Metals".

mgd: Million Gallons per Day.

MGMC: Malcolm Grow Medical Center

MIBK: Methyl Isobutyl Ketone.

MICRO: u (10^{-6})

ug/1: Micrograms per liter.

mg/l: Milligrams per liter.

MOGAS: Motor gasoline.

Mn: Chemical symbol for manganese.

MONITORING WELL: A well used to measure ground-water levels and to obtain ground-water samples for water quality analyses. As distinguished from observation wells, monitoring wells are often designed for longer term operations. They are constructed of materials for the site-specific climatic, hydrogeologic and contaminant conditions.

mr/hr: Millirem per hour; a measure of radioactivity.

MSL: Mean Sea Level.

MUNITION ITEMS: Munitions or portions of munitions having an explosive potential.

MUNITIONS RESIDUE: Non-explosive segments of waste munitions (i.e., bomb casings).

MWR: Morale Welfare and Recreation.

NCR: National Capital Region

NCO: Non-commissioned Officer.

NCOIC: Non-commissioned Officer In-Charge.

NDI: Non-destructive Inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929. A national datum system, tied to Mean Sea Level, but referenced primarily to land-based benchmarks.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration.

NON-CALCAREOUS: Not bearing calcium carbonate ($CaCO_3$) a characteristic mineral of marine paleoenvironment.

NPDES: National Pollutant Discharge Elimination System.

OBSERVATION WELL: An informally designed cased well, open to a specific geologic unit or formation, designed to allow the measurement of physical ground-water properties within the zone or unit of interest. Observation wells are designed to permit the measurement of water levels and in-situ parameters such as ground-water (flow velocity and flow direction. Not to be confused with a monitoring well, a well designed to permit accurate ground-water quality monitoring. Monitoring wells are constructed of materials compatible with site-specific climatic, hydrogeologic and contaminant conditions. Monitoring well installation and construction is planned to have minimal impacts on apparent ground-water quality and will often be for longer term operation compared with observation wells.

OEHL: Occupational and Environmental Health Laboratory.

OIC: Officer-In-Charge.

OPNS: Operations.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

OSI: Office of Special Investigations.

O&G: Symbols for oil and grease.

O/W Separator: Oil and Water Separator.

OUT CROP: Zone or area of exposure where a geologic unit or formation occurs at or near land surface. "Outcrop area" is an important factor in hydrogeologic studies as this zone usually corresponds to the point where significant recharge occurs. When this term is used as an intransitive verb: "Where the unit crops out....."

OXIDIZER: Material necessary to support combustion of fuel.

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PD-680: Cleaning solvent; petroleum distillate, Stoddard solvent.

PERCHED WATER TABLE: A water table above a relatively impermeable zone underlain by unsaturated rocks of sufficient permeability to allow ground-water movement.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The relative rate of water flow through a porous medium. The USDA, Soil Conservation Service describes permeability qualitatively as follows:

very slow	<0.06	inches/hour
slow	0.06 to 0.2	inches/hour
moderately slow	0.2 to 0.6	inches/hour
moderate	0.6 to 2.0	inches/hour
moderately rapid	2.0 to 6.0	inches/hour
rapid	6.0 to 20	inches/hour
very rapid	>20	inches/hour

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

PESTICIDE: An agent used to destroy pests. Pesticides include such specialty groups as herbicides, fungicides, insecticides, etc.

pH: Negative logarithm of hydrogen ion concentration.

PIEDMONT: An upland subdivision of the Appalachian Highlands Physiographic Province, extending from Alabama to New York. The zone is characterized by rolling hills and residual ridges formed by dissection of peneplained igneous and metamorphic terrain.

pico: 10^{-12}

PL: Public Law.

PMEL: Precision Measurement Equipment Lab.

POL: Petroleum, Oils and Lubricants.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTENTIALLY ACTIVE FAULT: A fault along which movement has occurred within the last 25-million years.

POTENTIOMETRIC SURFACE: The imaginary surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

ppb: Parts per billion by weight.

ppm: Parts per million by weight.

PRECIPITATION: Rainfall.

PROPELLANT: fuels, oxiders and monopropellants.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RECON: Reconnaissance.

RESISTIVITY: See Electrical Resistivity

RIPARIAN: Living or located on a riverbank.

RM: Resource Management.

RWDS: Radioactive Waste Disposal Site.

S: Storage site method.

SAC: Strategic Air Command.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SAPROLITE: A residual soil retaining the physical appearance or relict structure of the parent rock.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream. The residue which accumulates in liquid fuel storage tanks.

SMART: Structural Maintenance and Repair Team.

SOLE SOURCE: As in aquifer. The only source of potable water supplies of acceptable quality available in adequate quantities for a significant population. Sole source is a legal term which permits use control of the aquifer by designated regulatory authorities.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SPS: Special Police Squadron

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

SS: Supply Squadron.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

STRIKE: The compass direction or trend taken by a structural feature, such as bedding, folds, faults, etc. Strike is measured at a point when the specific feature intersects the topographic surface.

T: Treatment site method.

TAC: Tactical Air Command.

TACC: Tactical Air Control Center.

TCA: 1,1,1,-Trichloroethane.

TCE: Trichloroethylene, a solvent and suspected carcinogen.

TDS: Total Dissolved Solids.

TECTONIC (ally): Said of or pertaining to the forces and resulting structural or deformational features evident in the earth's crust. Tectonics usually deals with the broad architecture of the earth's outer crust.

TFW: Tactical Fighter Wing.

TIDAL STRIP: Physiographic subdivision commonly associated with (ocean) wave activity. Usually includes berms, beach ridges, tidal flats and related landforms typically produced by coastal erosional and depositional processes.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANS: Transportation Squadron.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TS: Transportation Squadron.

TSD: Treatment, storage or disposal sites/methods.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground-water.

US: United States.

USAF: United States Air Force.

USAFSS: United States Air Force Security Service.

USDA: United States Department of Agriculture.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

USMC: United States Marine Corps.

USN: United States Navy.

WAP: Waste Accumulation Point.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

WWTP: Wastewater Treatment Plant.

Zn: Chemical symbol for zinc.

APPENDIX J

REFERENCES

APPENDIX J

REFERENCES

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APPENDIX K

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CONTAMINATION SITES AT BOLLING AFB

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CONTAMINATION SITES AT BOLLING AFB

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